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Transactions of the Sixteenth Annual Meeting,

Hollywood Beach, Florida, January 14, 15, and 16, 1954

THE SOUTH ATLANTIC ASSOCIATION OF OBSTETRICIANS AND GYNECOLOGISTS A HISTORY OF THE FIRST FIFTEEN YEARS*

Presidential Address

H. HUDNALL WARE, JR., M.D., RICHMOND, VA.

THE South Atlantic Association of Obstetricians and Gynecologists has contributed much to the development and improvement of obstetrics and gynecology in Virginia, North Carolina, South Carolina, Georgia, and Florida, the states from which the active members of this Society are elected.

Plans for the organization of such an association were discussed in the early nineteen thirties. The first formal letter suggesting such a society was sent out October 23, 1937, to the obstetricians and gynecologists in the South Atlantic States by Dr. R. A. Ross of Duke University. A follow-up letter was dated November 1, 1937, and reported a uniformly favorable response to the original communication.

The organization meeting was held at the Charlotte Hotel, Charlotte, North Carolina, February 4 and 5, 1938. Dr. Ross, by his splendid executive ability and hard work, arranged both an organization meeting and a scientific

*Presented at the Sixteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Hollywood Beach, Florida, Jan. 14, 15, and 16, 1954. Dr. Ware points out that the Sixteenth Annual Meeting, so called, is really the Fourteenth, as no meetings were held in 1943, 1944, and 1945, and his history is written accordingly.

NOTE: The Editors accept no responsibility for the views and statements of authors as published in their "Original Communications."

program. Dr. R. E. Seibels was chairman of the committee on a constitution and by-laws, and Dr. W. Z. Bradford was chairman of the committee on local arrangements.

The guest speakers were Dr. Walter Dannreuther, New York City, President of the American Board of Obstetrics and Gynecology, Dr. Norris Vaux, Professor of Obstetrics, Jefferson Medical School, Philadelphia, Dr. Rudolph Holmes, Chicago, one of the organizers of the Central Association of Obstetricians and Gynecologists, and Dr. J. P. Pratt, Chief of the Department of Obstetrics and Gynecology, Henry Ford Hospital, Detroit.

Dr. Oren Moore of Charlotte, North Carolina, presided at the organization meeting and banquet.

The chairmen of the State Committees were:

Dr. F. O. Plunkett, Lynchburg, Virginia;
Dr. Ivan Proctor, Raleigh, North Carolina;
Dr. R. E. Seibels, Columbia, South Carolina;
Dr. E. D. Colvin, Atlanta, Georgia;
Dr. S. R. Norris, Jacksonville, Florida.

Those of you who attended the organization meeting and banquet probably still have vivid memories of the masterful manner in which Dr. Oren Moore presided at these meetings and succeeded in having a constitution and by-laws accepted by a group with many diverse opinions.

The organization was completed and seventy members were elected. Dr. J. R. (Bert) McCord of Atlanta, Georgia, was elected the first President of the Association. His reputation throughout the South and the nation, as an able and conservative obstetrician, gynecologist, and teacher, assured the success of this new Association of Obstetricians and Gynecologists. Any additional prestige needed by the Society was given when Dr. R. A. Ross of Durham, North Carolina, was chosen as Secretary and Treasurer.

The second meeting of the Association was held at the Fort Sumter Hotel, Charleston, South Carolina, February 10 and 11, 1939. President McCord presided, and an excellent program was presented. Dr. Edward A. Richardson, of Baltimore, an invited guest, presented a paper on "The Surgical Management of Uterine Prolapse and Associated Benign Pathology" and Dr. George W. Kosmak of New York City presented a paper on "What Do We Mean by Conservatism in Obstetrics?" The members presented eleven scientific papers, and fifty-five members and forty-five guests attended the meeting.

The third annual meeting was held at the Jefferson Hotel, Richmond, Virginia, February 9 and 10, 1940, with Dr. R. E. Seibels, the President, presiding. The guest speakers were Dr. Philip F. Williams of Philadelphia, and Dr. Arthur H. Curtis of Chicago.

The fourth meeting was held at the George Washington Hotel, Jacksonville, Florida, February 7 and 8, 1941, under the leadership of Dr. M. P. Rucker, the President. The guest speakers were Dr. N. J. Eastman of Balti-

more, and Dr. John Rock of Boston. The Virginia and Carolina members were surprised to see snow falling in Jacksonville and we were told it was the first snow there in twenty-five years.

The next meeting was at The Atlanta Biltmore Hotel, Atlanta, Georgia, in 1942. Dr. R. A. Bartholomew, the President, conducted the meeting and Dr. Alfred Beck of Brooklyn, New York, was the guest speaker. Sixty-three members and twenty-five guests attended this meeting. Six of the active members were on military duty. Dr. Oren Moore, of Charlotte, was elected President and Dr. R. A. Ross was chosen President-Elect. He had been Secretary and Treasurer of the Society since it was organized. Dr. T. J. Williams of the University of Virginia was elected Secretary and Treasurer.

The Association held no meetings in 1943, 1944, and 1945. One-fifth of the members were on active duty with the armed forces. Dr. Williams, the Secretary, maintained the interest in the Association by a series of letters to the members during the years in which there were no regular meetings.

The annual meetings of the Association were resumed February 15, 1946, at the Sedgefield Inn, Greensboro, North Carolina, with Dr. Oren Moore as the President. The guest speakers were Dr. Samuel A. Cosgrove of Jersey City, Dr. Archibald D. Campbell of Montreal, Dr. James E. Ayre, Montreal, and Dr. George Papanicolaou, New York City. The membership had increased to one hundred eight fellows, and twelve of these presented papers.

The 1947 annual meeting was held at the General Oglethorpe Hotel, Savannah, Georgia, February 7, 8, and 9. Dr. Robert A. Ross was President and the guest speakers were Dr. Robert A. Kimbrough of Philadelphia, and Dr. Frederick C. Irving of Boston.

The tenth anniversary meeting was February 12 to 14, 1948, at the Sheraton Bon Air Hotel, Augusta, Georgia, under the presidency of Dr. Randolph Perdue. This was the first meeting after our President-Elect, Dr. T. J. Williams, died August 19, 1947, in Charlottesville, Virginia. His absence cast a gloom over the meeting and he was missed by his many friends. Dr. E. D. Colvin, the Secretary, arranged an interesting program and the meeting was well attended with eighty-nine active members and seventy guests present. At this meeting, the membership limit was increased from one hundred fifty to two hundred. Dr. Carl Henry Davis of Wilmington, Delaware, and Dr. Joseph H. Farrow of New York City, were the guest speakers.

In 1949 the Association visited Virginia and the meeting was held at the Williamsburg Inn and Lodge, Williamsburg, February 10, 11 and 12. President S. R. Norris presided and gave his splendid address on "The Patient as a Human Being." Those of us who knew of Dr. Norris' illness for three years preceding his presidency realize the long hours of suffering he had undergone before writing this speech and the loving care and inspiration his devoted wife, Waldo, had given him. The guest speakers were Dr. William F. Mengert, Dallas, Texas, Dr. Fred H. Falls, Chicago, and Mr. Vernon M. Geddy, Williamsburg, the banquet speaker. One hundred one active fellows and fifty-two guests registered for this meeting, the largest attendance in the history of the Association.

The tenth annual meeting was held at the Roanoke Hotel, Roanoke, Virginia, February 9, 10, and 11, 1950. Dr. C. J. Andrews, the President, was unable to attend because of illness and Dr. Lester A. Wilson, presided over the business and scientific sessions. The guest speakers were Dr. R. Gordon Douglas, New York City, and Dr. Louis M. Hellman, Baltimore. Dr. Francis P. Gaines of Washington and Lee University was the banquet speaker. The following officers were elected for 1951: Dr. Lester A. Wilson, Charleston, South Carolina, President; Dr. E. D. Colvin, Atlanta, Georgia, President-Elect; and Dr. John C. Burwell, Jr., Greensboro, North Carolina, Secretary and Treasurer.

The following year the Association returned to Florida for its annual meeting, which was held at the Ormond Beach Hotel, Ormond Beach, Florida, February 8, 9, and 10, 1951. Dr. Lester A. Wilson was President and the guest speakers were Dr. Robert L. Faulkner of Cleveland, Ohio, and Dr. John Parks of Washington, D. C. Dr. E. D. Colvin was chosen President; Dr. Ivan M. Proctor, Vice-President; and Dr. F. Bayard Carter, President-Elect.

The twelfth annual meeting was held at the Belleview-Biltmore Hotel, Clearwater, Florida, January 24, 25, and 26, 1952. President Colvin presided at all of the meetings. Dr. Conrad G. Collins of New Orleans, Louisiana, and Dr. Arthur B. Hunt of Rochester, Minnesota, were the guest speakers.

In 1953 the Association visited Havana, Cuba, January 29, 30, and 31. President F. Bayard Carter presided at the meetings on the ship and at the Hotel Nacional. Dr. Norman F. Miller was the guest speaker. Many of the members of the Cuban Obstetrical and Gynecological Society participated in the program and extended to us every courtesy during our visit in Havana. We were entertained in a royal manner by Dr. Julio Ortiz-Perez, President of the Cuban Society and by other members of this Society.

With this review of the birth and growth of the South Atlantic Association, we must analyze our mistakes and plan for the future of our Association.

As stated in our program, "The purpose of the Association is to encourage study of the problems of Obstetrics and Gynecology; to improve the quality of Obstetrical and Gynecological practice both of its Fellows and of all other physicians residing in its territory; to cooperate with other similar organizations, both local and national, in the study and in the management of problems pertaining to Obstetrical and Gynecological practice; to grant recognition for unusual attainment or service in Obstetrical and Gynecological problems by including in its membership, as Fellows, specialists who reside within its territory, and, as Honorary Fellows, specialists who reside without its boundaries, who may be so elected, and to foster a spirit of comradeship and mutual helpfulness among those included in its Fellowship."

Evidence of the improvement in maternal and infant care in the South Atlantic States since 1937 can best be seen by the reduction in maternal, fetal, and infant deaths, as shown in Tables I, II, and III.

TABLE I. MATERNAL MORTALITY, RATES PER 1,000 LIVE BIRTHS

YEAR	FLORIDA	SOUTH CAROLINA	NORTH CAROLINA	GEORGIA	VIRGINIA
1937	6.7	7.7	5.4	7.4	5.6
1938	7.6	7.9	5.3	6.5	5.3
1950	1.3	1.6	1.2	1.6	1.0
1951	1.2	1.4	1.1	1.5	1.1
1952	0.8	1.4	1.0	1.3	0.8

TABLE II. FETAL DEATH RATES, PER 1,000 LIVE BIRTHS

YEAR	FLORIDA	SOUTH CAROLINA	NORTH CAROLINA	GEORGIA	VIRGINIA
1937	51.1	55.1	39.7	57.4	41.2
1938	48.9	50.6	38.5	52.7	39.4
1950	22.4	28.0	24.2	22.0	24.1
1951	21.8	26.2	23.3	22.0	23.1
1952	20.4	24.9	22.5	20.5	22.5

TABLE III. DEATHS OF INFANTS UNDER 1 YEAR OF AGE, PER 1,000 LIVE BIRTHS

YEAR	FLORIDA	SOUTH CAROLINA	NORTH CAROLINA	GEORGIA	VIRGINIA
1937	59.3	75.6	65.5	62.0	69.8
1938	58.2	80.3	68.6	67.7	66.1
1950	32.3	38.6	34.6	33.5	34.7
1951	33.1	36.6	32.8	34.2	34.4
1952	34.0	41.0	35.4	32.5	34.9

We have made some mistakes, but the Association has grown stronger and obstetrical and gynecological care has improved in the South Atlantic States since 1938.

We are now at the crossroads because our limit of membership has been filled. Shall we amend our constitution and by-laws and take in all obstetricians and gynecologists in the South Atlantic States or shall we keep the membership limited to two hundred and elect young men well trained in our specialty who have been active in their local and state societies and give promise of valuable contributions to the improvement of obstetrics and gynecology in the states included in our Association and in the nation?

With the growth of strong local and state obstetrical and gynecological societies, I believe we should keep our membership limited and hope to stimulate the young men in our territory to contribute more to the improvement of obstetrics and gynecology. They should look forward to membership in the South Atlantic Association as a recognition for contributions in this field. Our members should encourage the young obstetricians and gynecologists in their respective states to attend the annual meetings of this Society and request the secretary to invite these young specialists as guests.

It has been my good fortune to have attended the organization meeting and every annual meeting of this Society. My association with the members and other friends in this group has been a constant source of inspiration to me. I look forward to our annual reunions and hope to continue my record of attendance.

THE TREATMENT OF ECLAMPSIA*

A Survey of 76 Patients Observed From July 1, 1945, to January 1, 1954

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IT IS perhaps fitting to review and re-evaluate the treatment of eclampsia since various new, or rediscovered drugs have been advocated in the still empirical treatment of this enigma. To arrive at a conclusion regarding the best method of treatment more than mere statistics have to be considered, for the majority of eclamptic patients are treated in the smaller hospitals, and not in the medical centers. This study will show our method of treatment, and the results obtained.

Material

This study was made of 76 eclamptic patients treated on the Negro obstetrical service of Roper Hospital from July 1, 1945, to Jan. 1, 1954. During these eight and one-half years there were 7,205 deliveries, or an incidence of one case of eclampsia in 95 deliveries. No case is included for study that did not have at least one convulsive seizure. In a previous study[1] at Roper Hospital from 1931 to 1937, there were 3,909 deliveries with 111 patients who had convulsive seizures, or an incidence of one in 35.

The average age of the 76 eclamptic patients was 20.9 years. There were 9 patients who were 15 years of age, 4 were 35 years or older, and the oldest was 43 years of age.

Eclampsia occurs approximately three times more frequently in primigravidas,[2] and this was confirmed by our statistics. Fifty (65.8 per cent) of the patients were primigravidas, 11 (14.5 per cent) were secundigravidas, and 15 (19.7 per cent) were gravida iii or more. One patient was a gravida xiv.

Many of the patients who were delivered in this series had their prenatal care in clinics not under our control. Nineteen (25 per cent) of the patients had not seen a physician or a nurse during this pregnancy. Inadequate prenatal care was classified as such in the cases that were seen in the various clinics, or by a private physician, but the patients did not return for routine follow-up examinations. Many of these patients had only one prenatal visit, and were not seen again until they were admitted to the hospital in convulsions. Forty patients (52.6 per cent) were judged to have inadequate prenatal care. Prenatal care was considered adequate when the patient kept her appointments. Seventeen patients (22.4 per cent) received adequate prenatal care, in that they were seen at regular intervals; however, from the obstetrician's viewpoint, their prenatal care was woefully inadequate.

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Each of the patients studied in this series had at least one convulsion. The average number of convulsions was 4.7, with 13 patients (17.1 per cent) having only one convulsion. One patient had 22 convulsions. Twenty-two (28.9 per cent) of the patients had convulsions during the antepartum period only. Twenty patients (26.3 per cent) had convulsions during the intrapartum period, and 23 patients (30.3 per cent) had convulsions during the postpartum period. One patient (1.3 per cent) had convulsions during the ante- and intrapartum periods, 7 (9.2 per cent) had convulsions during the intra- and postpartum periods, while 3 (4 per cent) had convulsions during the ante-, intra-, and postpartum periods (Table I). It is quite apparent that adequate sedation was not given immediately post partum, since in 23 patients convulsive seizures were initiated during this period. We hope to correct this mistake in the future.

TABLE I. TIME OF OCCURRENCE OF CONVULSIONS

Ante partum	22	(28.9%)
Intra partum	20	(26.3%)
Post partum	23	(30.3%)
Ante-, and intra partum	1	(1.3%)
Intra-, and post partum	7	(9.2%)
Ante-, intra-, and post partum	3	(4.0%)

An accurate analysis of labor could be studied in 60 cases, and these patients were in labor an average of 13 hours. Labor was induced in 27 patients by rupture of the membranes with the Wilson trocar, and an average of 26 hours elapsed from the time the membranes were ruptured until delivery occurred. There were 5 cases in which more than 48 hours passed between amniotomy and delivery, the longest period of time being 120 hours. A somewhat less distorted picture is obtained if these 5 cases are not included in the statistics. Thus, in 22 cases of labor induced by rupture of the membranes, there is an average of 11.9 hours from amniotomy until delivery.

There were 68 mothers delivered of 71 fetuses, since there were 3 sets of twins in this series. The 8 remaining patients delivered prior to admission or died undelivered. There were 47 (66 per cent) spontaneous deliveries, and 19 forceps deliveries. Of these forceps deliveries 18 were low or outlet, and one midforceps. One mother was delivered by cesarean section because of cephalopelvic disproportion, and one by postmortem cesarean section of a premature infant that did not survive. There were 3 podalic versions, 2 of which occurred on the second twin. Of the 71 infants that were delivered 60 (84.5 per cent) were liveborn. There were 7 stillbirths (9.9 per cent), and 4 neonatal deaths (5.6 per cent). These statistics compare quite favorably with others in the literature.[3, 4, 5]

There were 3 maternal deaths (3.9 per cent), and a brief review of the cases are as follows:

CASE 1.—S. B. S. (No. 46847), a 21-year-old Negro woman, gravida i, was admitted on April 8, 1946, with the history of edema and severe headache. Prior to admission she had had convulsions at home for 8 to 10 hours before being seen by a physician, who gave her a "shot," and referred her to the hospital. She was semicomatose, with blood pressure 190/110, pulse 104, 4 plus albumin, blood urea nitrogen 11 mg. per cent, and uric acid 4.9 mg. per cent. The uterus was judged to be of 36 weeks' gestation. No uterine contractions were noted, and no fetal heart tones were heard. The cervix was dilated 3 cm., 50 per cent effaced with the vertex engaged. She was given morphine sulfate, ¼ grain, and 500 c.c. 10 per cent glucose. Forty-five minutes after admission the patient became pulseless, respiration ceased, and she failed to respond to stimulants. A postmortem section was performed. A faint fetal heart beat was present, but the infant failed to respond, and was pronounced

dead 5 minutes after delivery. No autopsy was performed on the mother, but the clinical impression is that she died either of peripheral circulatory collapse and pulmonary edema, or a cerebrovascular accident.

CASE 2.—J. M. (No. 35103), an 18-year-old gravida ii, para i, abortus 0, was admitted at term with a history of inadequate prenatal care. On the day of admission she complained of severe headache, and had three convulsions before coming to the hospital.

Her past history was not remarkable, with the exception of eclampsia with her first delivery in February, 1945.

On admission to Roper Hospital she was comatose, with a blood pressure of 230/150. Examination of the abdomen revealed a gravid uterus of 40 weeks' gestation. The fetal heart tones were good, but no uterine contractions were present. There was 3 plus edema of the extremities. Urinalysis revealed specific gravity 1.018, 3 plus albumin, 10 pus cells per high-power field, red blood cells, 2 to 4 per high-power field, 1 plus fine granular casts, and 2 plus coarse granular casts. The white blood count was 4,200, hemoglobin 14.5 Gm. Blood urea nitrogen was 21 mg. per cent. She was given morphine sulfate, ½ grain (32 mg.) intramuscularly, 500 c.c. 10 per cent glucose in water, and digitalization was begun. She received 10 c.c. of 25 per cent magnesium sulfate intravenously, and was also given aqueous penicillin, 30,000 units every three hours. The patient continued to have convulsions despite repeated injections of morphine sulfate and magnesium sulfate. Repeated aspirations were necessary to free the upper respiratory system of frothy blood-tinged sputum. The membranes were ruptured with a trocar, and three hours later she delivered a term infant in poor condition.

No further convulsions occurred, but the patient remained in semicoma. Twenty-four hours after admission her respiration became shallow, pulse weak, and death followed shortly. Autopsy revealed acute lobular pneumonia, congestion and edema (acute) of the lungs, toxic nephrosis, and focal necrosis of the liver.

CASE 3.—H. N. (No. 32344), an 18-year-old primagravida was admitted to Roper Hospital on Oct. 26, 1952, having had two generalized convulsions at home. Her past history revealed a previous admission for glomerulonephritis at the age of 10. On admission she was semicomatose, the blood pressure was 190/120, with 4 plus albumin. The remainder of the laboratory examination was within normal limits. Abdominal examination revealed a gravid uterus of 30 weeks' gestation. The patient was given morphine sulfate, and started on hypertonic glucose solution intravenously.

Convulsions continued despite adequate sedation. Pulmonary edema ensued, and she was digitalized. She grew progressively weaker, and died undelivered 40 hours after admission. Autopsy revealed a bicornate gravid uterus containing a fetus; pneumonia; pulmonary edema; and massive coagulative necrosis of the liver. Studies of the kidneys revealed no evidence of glomerulonephritis.

Of the 3 patients who died, one lived less than one hour after admission. This is included in the statistics, although it is certainly not a failure of our therapy. The other 2 died of pulmonary edema with circulatory collapse in one. Intravenous fluids were restricted in both cases, with one patient getting only 1,175 c.c. in 24 hours, yet death was apparently due to drowning in her own fluid.

Eclamptic patients are quite prone to have complications,[6] and this was found to be true as 32 (42.1 per cent) had one or more complications. Puerperal morbidity was classified as a temperature of 38° C. (100.4° F.) during any 2 of the 10 days post partum, exclusive of the first 24 hours, when the temperature is taken by mouth by a standard technique at least 4 times daily.[7] Using this criterion 21 patients (27.6 per cent) had puerperal morbidity. In 12 cases it was due to pyelonephritis, in 3 cases to endometritis, and the etiology could not be determined in 6 cases. Syphilis was diagnosed in 4 cases, and there was premature separation of a normally implanted placenta in one case. Three

patients lost more than 500 c.c. of blood at the time of delivery, and were classified as having a postpartum hemorrhage. The following complications occurred once: retained placenta, pulmonary infarction, retinal detachment, and congestive heart failure.

Treatment

Sedation in the form of morphine,[8] paraldehyde,[9] and the barbiturates is still being used in many clinics. Magnesium sulfate[10] is used alone or in combination in many instances. *Veratrum viride*[11] has been used for many years at the Cincinnati General Hospital, and the results obtained there have stimulated interest anew in this drug. Recently attention has been focused on the "antihypertensive" or "vasodilator" drugs such as Apresoline[12] in the treatment of the toxemias of pregnancy. Also antihistamines,[13] penicillin,[14] continuous spinal anesthesia,[15] and caudal anesthesia[16] have and have had their advocates. Fluid therapy has been in a state of chaos, in that limited fluid intake is advised by some to prevent the production of pulmonary edema,[17] while others[18] state that eclamptic patients are dehydrated, and therefore need to be hydrated. Thus, it is extremely difficult to peruse the literature and arrive at a definite opinion regarding the treatment of choice.

TABLE II. OUTLINE OF ROUTINE TREATMENT AT ROPER HOSPITAL

1. Absolute bed rest in a dark, quiet room, with a physician (or medical student) in attendance. Blood pressure cuff constantly on patient's arm, and blood pressure recorded every 30 minutes, and after each convulsion.
2. Morphine sulfate, ½ (32 mg.) to ¼ grain (16 mg.) initially, then ¼ grain (16 mg.) as needed to control convulsions.
3. Five hundred cubic centimeters of 5 or 10 per cent glucose in distilled water every 6 hours.
4. Rupture of the membranes as soon as the convulsions are controlled.
5. Delivery under local anesthesia with morphine sulfate, ¼ grain (16 mg.), to the mother as soon as the baby is delivered.
6. Indwelling catheter in the bladder for constant drainage.
7. Oxygen by nasal catheter as indicated.
8. Magnesium sulfate intravenously and intramuscularly to control convulsions as needed.
9. Digitalization when pulmonary edema or cardiac failure occurs.

There are various factors that must be considered in arriving at the best treatment for eclampsia. Certainly the treatment at a large medical center can and should be different from that in a small community hospital in the South, where trained ancillary medical personnel and obstetrical consultants are limited. Much more than the mere physical plant of a hospital is necessary in the adequate treatment of eclampsia. Another factor is the frequency with which the physician or obstetrician sees and treats the toxemias of pregnancy. All too often medical or surgical consultants are unfamiliar with the physiology and pathology of eclampsia, since they rarely see a case. Their opinion must

be based on their knowledge of the medical literature or some recent drug literature that has crossed their desks, and not on experience. This makes for inconsistency and false evaluation of treatment, and must of necessity decrease the chances of maternal survival. The excellent results reported with some drugs (*Veratrum viride*) are not due to the drug alone, but to the experience and skill of the obstetricians using it, and to the careful and close management of the case.

It is felt that maternal mortality from eclampsia can be reduced by making the treatment of eclampsia as simple as possible, and by using drugs that are familiar to every medical student and physician. When the diagnosis of eclampsia is made at Roper Hospital, treatment is carried out according to the general plan shown in Table II.

Whether the convulsions occur ante partum, intra partum, or post partum, the treatment is essentially the same. Constant attendance is an essential part of treatment so that the minute-to-minute changes may be detected, and the treatment altered as the condition of the patient varies.

Initial adequate sedation to control convulsions cannot be overemphasized, for there is a tendency toward undertreatment in the beginning, and overtreatment terminally. The initial sedation consists of ¼ (16 mg.) to ½ grain (32 mg.) of morphine given intramuscularly. If the patient is edematous, however, it is given intravenously. This is repeated in two hours, or sooner if the patient becomes restless or another convulsion occurs. The rate of respiration is an excellent measurement of adequate, inadequate, or excessive sedation. Respirations are maintained if possible at 12 to 14 per minute, and should never be depressed below 10 per minute. In general eclamptic patients are usually undersedated, not oversedated. Morphine has been said to produce an antidiuretic response by a reduction in plasma flow, and an increase in reabsorption fraction.[19]

An indwelling catheter is placed in the bladder, and connected to constant drainage, so that the urinary output can be carefully watched. Oliguria or anuria did not develop to such an extent in any patient in this series that morphine was discontinued because of its supposedly antidiuretic effect.

After the patient is sedated, 500 c.c. of 5 or 10 per cent glucose is given intravenously, and this is repeated every 6 hours. This is given to promote diuresis, and decrease the intracellular edema. The daily intake is limited to 2,000 c.c., since there is a definite danger of overhydration and the development of pulmonary edema. Intravenous glucose also provides for caloric needs, and prevents protein catabolism.

Other medication is used as needed. Oxygen by nasal catheter or by tent is administered if the respirations are 10 or less per minute, or if there is respiratory distress or cyanosis. This is continued as long as it is clinically indicated. Magnesium sulfate intravenously or intramuscularly is used with morphine in a small percentage of cases where the convulsions apparently are not controlled by the morphine sulfate. This is usually given first intravenously, 20 c.c. of a 10 per cent solution. Digitalis is not given routinely; but with evidence of cardiac failure or pulmonary edema digitalization is indicated and carried out.

Once the convulsions are controlled for three to four hours, if the patient is still undelivered, a sterile pelvic examination is made, and the amniotic sac ruptured with the Wilson trocar. Twenty to thirty minutes prior to the vaginal examination morphine is given so that the patient will be well sedated. It is felt that this is an essential part of the treatment, and the sooner delivery takes place, the better it is for the mother as well as for the fetus. The delivery of the mother is under pudendal block, or local anesthesia with 1 per cent Novocain. Low or outlet forceps are used as indicated, and morphine sulfate, ¼ grain (16 mg.), is given intramuscularly following delivery. In spite of heavy sedation with morphine the vast majority of infants cried immediately after delivery and respiratory depression was not a conspicuous feature even though some of the infants were premature.

Once delivery has taken place, or the convulsions have been controlled in postpartum eclampsia, sedation is decreased gradually, and one of the barbiturates is substituted for morphine. The barbiturate dosage is gradually decreased until the patient is receiving phenobarbital, ½ grain (30 mg.) four times a day orally. A diet high in proteins is given when food is taken orally. Hypoproteinemia is corrected if present, and whole blood transfusions and iron, by mouth, are given if indicated for secondary anemia.

Summary

1. In this series there was one case of eclampsia for every 95 deliveries.

2. There were three maternal deaths for a maternal mortality of 3.9 per cent.

3. There was a fetal mortality of 15.5 per cent.

4. Morphine sulfate is an excellent drug for the control of convulsions when used in adequate amounts.

5. Pulmonary edema is a constant danger, thus fluids must be given with caution.

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Discussion

DR. KENNETH A. PODGER, Durham, N. C.—The reading of this paper stimulated me to see what our eclampsia rate has been in the Durham, North Carolina, area. At Duke Hospital, which has a private, as well as a clinic service, the eclampsia rate in the past twenty years was 275 in 21,333 deliveries or 1 in every 77 deliveries. Watts Hospital, which is the County Hospital and 90 per cent private, showed 1 case of eclampsia in every 480 deliveries for the past five-year period. Lincoln Hospital, an all Negro hospital, could not give me accurate statistics due to incomplete case records but thought theirs was about 1 in 274 deliveries.

In our own private practice we had 2 cases of eclampsia in the last 2,324 consecutive deliveries. One of them was at 7 months and occurred following a sojourn in Europe during which the patient received no prenatal care. This patient delivered a stillborn infant following her convulsive seizures. The other patient was a gravida xi who had her convulsions on the fifth postpartum day following a normal delivery and in spite of constant heavy postpartum sedation. The follow-up in the first patient shows that a second pregnancy occurred two years later, and at a leading medical center in Texas a hysterectomy was done at 7 months because of severe pre-eclampsia. The other patient has been followed by us and shows no sign of residual hypertension or kidney damage.

In going over our private case histories it was astounding to me to find the high incidence of toxemia and pre-eclampsia in spite of our efforts at "weight control." I firmly believe the only reason our incidence of eclampsia is low is due to the delivering of the patient by conservative measures, if possible, when she does not respond to the diet, rest, and sedation regime.

I would like to ask Dr. Hester if there has been any follow-up program in his series to determine any residual damage to the mother by her previous eclamptic state. Once the eclamptic state has been reached, I, for one, certainly agree with his method of treatment outlined.

DR. EUGENE F. McCALL, Jacksonville, Fla.—Dr. Hester's statistics for age, parity, and race are similar to most of the reported statistics but his incidence of eclampsia is higher than that in our immediate vicinity. In our Charity Hospital we had 14 cases of eclampsia in 2,906 deliveries, or an incidence of 1 in 207 deliveries; in a large private hospital 2 cases, both post partum, in 6,600 deliveries, and one case from our own files in more than 3,000 deliveries.

It is surprising that of his eclamptic patients 22.4 per cent had received adequate prenatal care. Only one in our 14 cases had any prenatal care. This case occurred ten days post partum following the delivery of a twin pregnancy. The records show that the patient was permitted to leave the hospital with a high diastolic pressure "104 mm." on the fourth postpartum day. Adequate care, I am sure, could have prevented this patient from developing postpartum eclampsia.

Dr. Hester's reported maternal and fetal salvage are excellent and compare favorably with those given in most other reports. Deaths from eclampsia seem to be more related to the degree of visceral damage already sustained at the onset of treatment than to the form of treatment employed. As the essayist has so aptly remarked, "The excellent results reported with some drugs . . . are not due to the drug alone, but to the experience and skill of the obstetrician using it." With this statement I most heartily agree. However, I would like to remark that we have found the more liberal use of the barbiturates in conjunction with morphine and/or Demerol to be very helpful.

I would like to ask Dr. Hester a question at this point: Do you have a toxemia clinic?

The long latent period between amniotiomy and delivery in this series could, I believe, have been safely speeded up by the judicious use of intravenous Pitocin, thereby perhaps reducing the maternal morbidity.

DR. HESTER (Closing).—In reply to Dr. McCall's questions, we are extremely interested in residual hypertension following pregnancy, whether or not the pregnancy had been complicated by toxemia. Enough time, however, has not elapsed for us to evaluate our statistics. As he noted in his discussion, our incidence of eclampsia is much higher than in other reports. However, prior to July 1, 1950, only complicated cases were admitted to the Negro obstetrical service of Roper Hospital, which gave us a very high incidence of eclampsia, as compared to the number of patients delivered. Our incidence is now much lower.

We do not have a toxemia clinic, as we prefer to study each individual case in the routine clinic.

INTRAVENOUS PITOCIN IN THE MANAGEMENT OF THE TOXEMIAS OF PREGNANCY*

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THE termination of pregnancy at varying stages of gestation is often desirable and necessary in patients suffering from the toxemias of pregnancy. Usually the pregnancy is interrupted during the last trimester of the gestation. In a great many instances termination is effected by means of cesarean section, thus producing an obstetrical cripple in so far as future childbearing is concerned. It is the purpose of this report to present for the consideration of the profession an alternate method of inducing delivery in the event of the occurrence of toxemias of pregnancy, which will be safe for the mother, allow as many future pregnancies as are desirable, and give as much assurance of a live birth as the methods now in use.

The reports of the Margaret Hague Maternity Center[1] and others[2] indicate that the duration of a given toxemia of pregnancy is probably of more significance in relation to permanent hypertension than is the severity of the disease. They indicate that even a mild toxemia of over three to four weeks' duration in a primipara is more likely to result in permanent vascular damage than is a more severe toxemia of shorter duration. Our experiences with the toxemias of pregnancy at the Medical College of Virginia Hospitals have borne out these ideas. Consequently we feel that when a patient suffering from a toxemia of pregnancy fails to show improvement, or demonstrates a worsening of the condition, after a reasonable period of conservative therapy, her pregnancy should be terminated. It is felt that the use of intravenous Pitocin will help to solve the baffling problem connected with the so-called late management of a good many of these cases.

The usual treatment of the toxemias of pregnancy in our hospitals consists of bed rest, sedation, adequate elimination, correction of fluid and electrolyte balances as indicated, with the termination of pregnancy carried out when the patient fails to respond or to show further improvement on this regimen. In those cases of severe pre-eclamptic toxemia where the onset of convulsions seems imminent, we do not advocate temporization, but believe that cesarean section still offers the most expeditious means of terminating the pregnancy when it becomes evident that the patient will not respond to the conservative regimen. The method of induction, to be described below, in which the intravenous Pitocin is used, offers aid in these categories of cases: (1) those border-

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line cases of toxemia where the time element is becoming a disturbing factor; (2) the so-called controlled pre-eclamptic and eclamptic toxemias, where the attendant is reluctant to discharge the patient from the hospital prior to delivery; (3) the cases of prepregnancy hypertension with superimposed acute toxemias of pregnancy after the latter have been brought under control.

Prior to the use of intravenous Pitocin to initiate labor, the existence of cephalopelvic disproportion must be ruled out. This is done by careful clinical and, when indicated, x-ray pelvimetry. At the time of this examination, the status of the cervix and the presentation and position of the fetus are noted.

It has been stressed time and time again that the use of Piocin or any oxytocic agent, prior to the birth of the baby, in a pregnant woman is a hazardous procedure[3, 4] and one that should be undertaken only by well-trained personnel. We are in complete accord with these views and it is mandatory on our service that a member of the obstetrical staff, either house or attending, be in constant attendance on any patient during the entire period that she receives Pitocin. One must take particular care during the initiation of the therapy that too large a dose is not permitted to enter the vein immediately following the introduction of the needle through the wall of the vein. If, at any time during the course of any part of the therapy, any deleterious effects are noted, the solution is immediately stopped. The duration, character, frequency, and intensity of the uterine contractions are noted continuously at the beginning of the treatment and at least every five minutes after the first fifteen minutes. The same precautions are observed in regard to the patient's pulse and blood pressure and the fetal heart sounds. We feel that an intravenous solution of Pitocin permits more rapid control of the situation in the event of the occurrence of any deleterious effects to either the mother or the fetus than does the hypodermic or intramuscular use of this agent.

We employ a 1:2,000 concentration of Pitocin in 5 per cent dextrose in distilled water, generally using 0.25 c.c. in 500 c.c., respectively. This is allowed to run at a rate of 30 to 40 drops per minute. All patients receiving Pitocin are placed in the labor rooms and remain there as long as they are receiving the intravenous solution or having any uterine contractions. While they are receiving therapy, careful attention is paid to their needs for analgesia.

Since the majority of the patients receiving intravenous Pitocin have cervices that are not amenable to the usual methods of inducing labor, it is usually necessary that they receive the solution over a period of several days before labor begins. Usually, immediately following the introduction of the solution into the patient's vein, and throughout the duration of treatment, fairly good uterine contractions commence and continue. Following the cessation of flow of the solution, however, the contractions may stop. The patient is then returned to her room but brought back to the labor rooms on succeeding days until labor either continues after the solution has again run in or the cervix is amenable to rupture of the membranes.

Eastman[5, 6] has indicated that attempts at induction of labor through the use of pitocin or Pituitrin, in the face of an unripe cervix, are doomed to fail-

ure. This has not been our experience, nor that of the Bowman Gray School of Medicine group. Mauzy and Donnelly[7] reported 18 successful inductions with the use of this agent in patients with unfavorable cervices. Douglas, in discussing Mauzy's report,[7] stated that of 42 patients in whom labor was induced by means of Pitocin over a two-year period at the New York Lying-In Hospital, all had cervices that were considered unfavorable for induction. In our series at the Medical College of Virginia Hospitals there were 35 patients in whom labor was successfully induced by this means, in all of whom the cervices were considered "unripe" (Table I). There were 9 patients in our series who had Pitocin for only one administration, resulting in continuation of labor to delivery, while one patient received the solution for twelve days. Six patients received the solution for two days, and 11 patients required three separate days of treatment prior to the onset of effective labor (Table II). Thus it becomes evident that one cannot state that Pitocin induction has failed after only one or two administrations of an effective solution.

TABLE I. SUCCESSFUL INDUCTIONS WITH INTRAVENOUS PITOCIN

Mauzy	18
Douglas	42
Medical College of Virginia	35
Total	95

TABLE II. NUMBER OF DAYS OF PITOCIN THERAPY

Days	1	2	3	4	5	6	9	10	12
Patients	9	6	11	2	2	2	1	1	1

The material reported in this study consists of unselected cases of the toxemias of pregnancy falling into the three categories enumerated above but does not include the fulminating cases in which it was deemed inadvisable to delay active intervention. There were 23 cases bearing the diagnosis of acute pre-eclamptic toxemia, 11 cases of hypertensive cardiovascular-renal disease with superimposed acute toxemia, and one case of eclampsia (Table III).

TABLE III. INDICATIONS FOR USE OF INTRAVENOUS PITOCIN

Acute pre-eclampsia	23
Hypertensive cardiovascular-renal disease with pre-eclampsia	11
Eclampsia (controlled)	1

There were nine primigravidas in this group, while the remainder of the patients varied from para i to para v, or greater. The periods of gestation varied from thirty-two weeks to several weeks past term, with well over half the cases undergoing successful induction of labor at, or prior to, the thirty-eighth week of pregnancy (Table IV). There were no maternal deaths in this series and no untoward effects were noted in any mother as a result of the use of intravenous Pitocin. There was one stillbirth in our series (Table V). Nine of the babies in this group weighed 2,500 grams or less, while 26 of these infants weighed over 2,500 grams (Table VI).

TABLE IV. PERIODS OF GESTATION

NO. WEEKS	PATIENTS
32	2
34	5
36	6
38	10
40	8
Over 40	4

TABLE V. RESULTS

Maternal deaths	0
Maternal accidents	0
Stillbirths	1
Neonatal deaths	0

TABLE VI. WEIGHTS OF BABIES

GRAMS	NO.
1,500-2,000	3
2,000-2,500	6
2,500-3,000	9
3,000-3,500	12
3,500-4,000	4
Over 4,000	1

The stillbirth occurred in a 17-year-old Negro primigravida, who had a diagnosis of moderately severe acute pre-eclampsia in the twenty-sixth week of pregnancy. After approximately six weeks of conservative therapy in the hospital, during which time she indicated some improvement, particularly in the first four weeks of her hospitalization, she was started on intravenous Pitocin. She received the Pitocin over a period of four days, and on the fourth day her labor progressed to the point of delivery. During the entire time of treatment with intravenous Pitocin, the fetal heart tones were regular with a normal rate at the beginning, during, and at the cessation of the flow the solution, except that on the day of delivery the fetal heart rate, which was recorded as being 150 per minute at the commencement of therapy, dropped to 80 just prior to the completion of treatment. At that time, however, the patient was in very active labor and delivery was felt to be imminent in a mater of minutes. Subsequently, delivery was effected spontaneously, following a median episiotomy and manual rotation of the vertex from an occiput posterior position to occiput anterior. The infant weighed 1,750 grams. One-third of the maternal surface of the placenta was described as being prematurely separated and there was an occult prolapse of the cord.

The following case report is included to demonstrate the effectiveness of intravenous Pitocin in one of the most unfavorable of cases, in so far as induction of labor is concerned.

Mrs. F. R., a 22-year-old primigravida, was admitted to the Medical College of Virginia Hospital on Feb. 14, 1952, with a diagnosis of acute pre-eclampsia. Her last menstrual period had occurred on July 18, 1951, with an expected date of confinement of April 25, 1952. The present pregnancy had been uneventful until Feb. 10, 1952, when she presented herself with a blood pressure of 150/90, which had been averaging 106/66, and a trace of albumin in the urine. Four days later her blood pressure was recorded as 144/100; she had gained 2 pounds in weight and there was a 1 plus albuminuria. She was hospitalized after this office visit and placed on the usual pre-eclamptic regimen. The only significant findings in the hospital were hypoproteinemia, albuminuria, and hypertension. After two and one-half weeks of hospitalization, she had failed to show any improvement in so far as her blood pressure was concerned, and it was decided to terminate the preg-

nancy. The height of the fundus uteri at that time was 28 cm. She received a 1:2,000 solution of Pitocin intravenously on three successive days at a rate of 40 drops per minute. On the third day (March 7, 1952), approximately seven weeks before term, labor continued and she was delivered by breech extraction of a living male child that weighed 2,300 grams. On the initial day of treatment, the cervix was described as being long, thick, and closed, with the presenting part floating. Her blood pressure preceding treatment on each day averaged 152/101 and at the termination of treatment 140/92. Six week post partum her blood pressure was 134/84; at eleven weeks it was 114/76, and seven months following delivery it was 120/66. This patient is now approximately three months pregnant with a blood pressure of 112/66 and a normal urinalysis. The first baby is alive and well.

Thirty-five cases of successful induction of labor through the use of intravenous Pitocin in patients whose cervices were not considered amenable to induction of labor have been presented. All of these patients either had at the time of induction, or had recently experienced, one of the toxemias of pregnancy. No deleterious effects were noted in any mother as a result of the use of intravenous Pitocin. There was one stillbirth in this series. While the follow-ups had not been completed for the entire series at the time this report was written, all of the patients who had been checked possessed normal blood pressures, urinary and blood chemistry findings, with the exception of those who first presented themselves with prepregnancy hypertension. The dangers and precautions to be observed in the use of any oxytocic agent before the birtth of the baby have been briefly summarized and reiterated. It must again be stressed that the use of intravenous Pitocin is not advocated in the management of those fulminating cases of toxemia which fail to respond to conservative measures.

It is felt that intravenous Pitocin is a valuable adjunct to our armamentarium in the controlled toxemias of pregnancy, the so-called borderline cases of toxemia of pregnancy where the time factor becomes disturbing, and in prepregnancy hypertension with superimposed acute pre-eclampsia. It is further believed that this method of management of the toxemias of pregnancy will reduce the number of cesarean sections necessary to treat these conditions effectively, thus reducing the number of obstetrical cripples.

The results reported by other writers[7] and our own experiences with the use of this agent in the toxemias of pregnancy seem to indicate that, in experienced hands and with careful selection of cases, it is a safe and effective method of dealing with the late management of toxemias of pregnancy.

We wish to express our sincere gratitude to Dr. H. H. Ware, Jr., Professor of Obstetrics and Gynecology of the Medical College of Virginia Hospitals, for his aid in the preparation of this report.

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Discussion

DR. PETER C. GRAFFAGNINO, Columbus, Ga.—The point is made and established convincingly in Dr. Parker's paper that intravenous Pitocin is an effective means of induction in patients with unfavorable cervices. Continued repeated attempts ultimately resulted in productive labor in all 35 cases.

As indicated in Table II labor was successfully induced in the majority (26 of 35) after the third attempt; and in all but 3 by the sixth attempt. The persistence is to be admired. After 9 or 10 tries, however, I might be a little discouraged. By the twelfth time I doubt whether I could outlast the questions of the patient's family or survive the heckling of my associate about my decision (made two weeks previously) to stop temporizing and terminate pregnancy.

The 38 cases were unselected, although some fulminating cases not responding to toxemia control are implied to have been terminated by other means. It is not stated whether or not intravenous Pitocin was tried on any of these prior to the abandonment of conservative therapy.

Also the question comes to mind as to whether, in the later course of some of these repeated attempts, any other means, such as stripping or rupture of the membranes, was used as an adjunct.

In the two main hospitals of our community, over the past three-year period, intravenous Pitocin for the induction of labor was used in 80 cases. In 22 of these cases the indication for induction was that of toxemia. In this group, as in Dr. Parker's series, there were no maternal complications. There was only one stillbirth, this occurring in a patient whose fetal heart tones were lost two days prior to the induction. Thirteen cases were successfully induced on the first attempt, 6 on the second, and one on the fourth. Of the remaining 2, in one case the intravenous method was abandoned after the third attempt, but fractional intramuscular doses were successful on the fourth try; in the other, after an unsuccessful fourth attempt, the patient went into labor spontaneously two days later.

There were 7 nulliparas in this group of 22. Only 4 patients, however, were 38 weeks pregnant, or less, and none was earlier than 36 weeks.

Unlike the cases presented by Dr. Parker, the 80 inductions, including the 22 toxemic cases, were hardly a well-supervised series. Of some 20 practitioners who deliver babies in our community only four are board-qualified in the specialty. It was interesting to note in reviewing these records that only 2 of the 80 cases were handled by a board-qualified man. In only 10, at the most, of the 80 cases was there any supervision approaching that outlined by Dr. Parker and adhered to by most of us who are aware of the inherent dangers of the procedure. In the other 70 cases the infusion was either ordered by phone or started and left to run, with instructions to the labor room nurses to notify the doctor if labor started, or when the pains became hard, or when the cervix became a certain amount dilated. This is somewhat disconcerting. The warnings that are stressed, not only in this paper but in all papers dealing with intravenous Pitocin, are convincing enough to make the trained obstetrician wary of its use except under proper supervision. On the other hand the obstetrician with less training and the general practitioner seem to be adopting the method unconcernedly—and almost as wholeheartedly as the "liver shot."

Is it safer under poorly supervised conditions to use minute fractional doses of Pitocin intramuscularly rather than a dilute intravenous infusion?

An early paper by Dr. Hellman demonstrated that the continuous intravenous administration of Pitocin in cases of uterine inertia produced a more effective and more physiologic pattern of uterine contraction than did the intermittent intramuscular injections. Dr. Ferguson, who recently recorded two instances of ruptured uterus during Pitocin infusions, in a paper published in 1950, reported 28 inductions in which a dilute solution

(4 minims to 1,000 c.c.) was allowed to run unregulated through a fine needle. These inductions were deliberately unsupervised, relying on the nurse or patient's family to discontinue the infusion when regular contractions were established. This small study (in which there were also no maternal or fetal complications) was undertaken in an attempt to evaluate the safety of such a method under conditions simulating those of smaller hospitals and rural practice.

The use of intravenous Pitocin for induction presents a problem to the conscientious obstetrician who works with an inadequate or nonexistent house staff. Rightly or wrongly, I believe he considers that there is less danger in an unsupervised induction with minute fractional doses intramuscularly than in an unsupervised Pitocin infusion.

DR. C. H. MAUZY, Winston-Salem, N. C.—On Dec. 22, 1953, a patient's chart went to the North Carolina Baptist Hospital record room, with the following information: (1) pregnancy, intrauterine, delivered; (2) vertex left occipitotransverse; (3) term birth, stillborn, hydrocephalus and spina bifida; (4) toxemia of pregnancy; (5) hypertensive cardiovascular disease; (6) prolonged labor, uterine inertia; (7) intravenous Pitocin; (8) shock due to acute blood loss, transfusions; (9) laparotomy and repair of the uterus; (10) postpartum hemorrhage; (11) maternal death.

Mrs. R. B., History No. 178001, a white woman, aged 42 years, private case of an attending obstetrician, was admitted at term on December 20, at 2:15 A.M. with a history of ruptured membranes, bloody show, and labor pains. She was a gravida ii, para i, who had been delivered in 1947 of a 9 pound, 10 ounce child after twenty-four hours of hard labor. The patient weighed 231 pounds—a gain of 36 pounds—and was 5 feet, 5 inches tall. Her blood pressure was 180/110. The fundus was 37 cm. above the symphysis, the fetal heart rate 152 per minute, and the fetal position could not be ascertained by abdominal or rectal examination. Other clinical findings were within normal limits although on the following day the urine had a trace of albumin.

Labor was desultory in type and characteristic of uterine inertia. She was seen in consultation thirty hours after admission and x-rays were advised to determine fetal position. Cautious administration of intravenous Pitocin was recommended if a cephalic presentation was present, as well as adequate sedation for the hypertension.

A plain film of the abdomen showed the presence of a single fetus in vertex presentation. Pitocin was started at 3:50 P.M., December 21 (5 minims in 500 c.c. of 5 per cent dextrose in water) at a rate of 12 drops per minute. The blood pressure was 198/112 and the fetal heart rate 150 per minute. Uterine contractions occurred every two minutes and were listed as moderate with a duration of 45 to 50 seconds. These, along with the blood pressure and fetal heart rate, were recorded every 15 minutes.

At 5:15 P.M. the blood pressure was 185/100 and the rate of flow of Pitocin was 36 drops. Contractions were occurring every minute and lasting 50 seconds. They were recorded as "hard." The needle came out of the vein at 5:35 P.M. and contractions became irregular. The blood pressure remained around 180/110.

At 6:45 P.M. intravenous Pitocin was started again, and 15 minutes later the blood pressure dropped to 60/40 with obvious signs of shock. She was treated immediately with fluids, blood, and oxygen, and her blood pressure returned to 130/90.

The patient was seen again by the consultant, and a laparotomy was advised. This was performed at 9:15 P.M., a delay of two hours. At the time of operation 1,000 c.c. of blood was present in the abdominal cavity and the body of a large infant that weighed 4,600 grams was extruding through a complete tear extending from the right cornu through the cervix and laterally into the broad ligament. The child was stillborn with hydrocephalus and spina bifida. Two hours and twenty minutes were consumed in repairing the ruptured uterus. The patient received 3,500 c.c. of blood prior to and during this procedure. She was returned to her room in only fair condition and 30 minutes later had

profuse vaginal bleeding with an estimated blood loss of 1,500 c.c. She was given oxytocics and 2,500 c.c. of blood but died at 4:25 A.M., Dec. 22, 1953. Autopsy was not obtained.

In summary, this was a toxemic patient with definite cephalopelvic disproportion due to hydrocephalus who was given intravenous Pitocin to stimulate labor. The uterus was ruptured and a laparotomy was performed. The uterus was not removed but was repaired, and the patient died four hours after the operation.

If we were limiting our remarks to induction of labor, maybe we could omit this case because Pitocin was used to stimulate labor, but that it was used in the management of a toxemic patient cannot be denied. Likewise, we might excuse ourselves by saying hydrocephalus alone is often responsible for a ruptured uterus, or, better, why not put the blame on the attending obstetrician who is not listed as a member of our department? This is wishful thinking, because our department accepts the responsibility and reports the results of every obstetric patient admitted to the North Carolina Baptist Hospital. It has been the policy of our department to report the facts as honestly as we know how, and we accept the blame for this patient's demise and will list it in our series of intravenous Pitocin in toxemia of pregnancy.

It is obvious that poor obstetrics was practiced throughout the management of this case. That the following glaring mistakes occurred is hard to believe but cannot be ignored:

1. Failure to obtain a lateral film and/or pelvimetry.
2. The use of intravenous Pitocin in the face of questionable faulty presentation or disproportion.
3. Failure to remove the uterus instead of attempting to repair it, which required two hours and twenty minutes and was followed by postpartum hemorrhage and probably a large amount of concealed bleeding.

It is with some reticence and chagrin that I report these facts because we have always warned others of these dangers. To our distinguished guests, visitors, and members, I offer my apologies and trust that such gross negligence has not and will not occur in your department. My apologies also to Dr. Parker who was kind enough to send me his manuscript in advance and which I will not have time to discuss.

We have added seven more premature births to the original 19 reported to this Association in 1952, and have used Pitocin in over 100 toxemic patients. The results have been gratifying in the majority of cases. We believe we have lowered our fetal mortality and prevented ill-advised cesarean sections. We hope to report this more completely at a later date.

We believe, like Dr. Parker and his colleagues at the Medical College of Virginia, that there is a definite place for intravenous Pitocin in toxemia of pregnancy provided one recognizes the hazards he has outlined. Our department will continue to use intravenous Pitocin and trust that this tragic case will make us more cognizant than ever of its limitations and dangers.

DR. R. GORDON DOUGLAS, New York, N. Y.—Dr. Parker and Dr. Roberts have demonstrated quite conclusively in 35 patients with toxemia of pregnancy that labor may be induced prematurely with safety to mother and child. Furthermore, their experience has clearly established that this method of induction may be employed when the cervix is considered completely unfavorable for induction. It might well be anticipated that all mothers suffering from this complication would survive, but I consider it outstanding that 35 women with more or less severe toxemia of pregnancy were delivered with but one fetal death. The one instance of fetal loss occurred in a 17-year-old Negro primigravida who developed a severe pre-eclampsia in the twenty-sixth week of pregnancy. There may be some question as to the cause of the premature separation of the placenta in this patient, but I do not believe that the method of induction employed was the responsible factor. We have all seen this complication in toxemia patients, either before

or during labor, in whom labor was not induced. I am sure that the outstanding success with respect to fetal survival is due to the vigilence and constant care by a responsible doctor during the entire period that the Pitocin is being administered.

The authors have a concept, I believe, with which I am in complete agreement, namely, that a toxemia in a given pregnancy can be cured only by termination of the pregnancy. Management with our best means of tretament may effect water elimination, some decrease in the elevation of the blood pressure, and at times some decrease in the daily excretion of protein in the urine. Even with such apparent improvement, however, spasm in the arterioles usually continues and sometimes actually increases, and serious hazards to the fetus exist. I agree with the general philosophy of the authors that the toxemia should not be permitted to continue indefinitely.

I find myself at variance with Drs. Parker and Roberts on two principles of their technique. I do not believe that Pitocin induction should be given, in general, on more than three successive days. When induction takes ten or twelve days, we have usually inflicted a good deal of physical and psychic trauma which I do not believe is justifiable. The second point concerns the concentration of Pitocin and its rate of administration. As I understand it, they used for the most part a concentration of 1:2,000 and they more or less employed a constant rate of administration of 35 to 40 drops of this solution per minute. Our experience with this method of induction indicates that there is a tremendous variability in different patients in their susceptibility to Pitocin. In general, as term is approached, less of the substance is required to stimulate uterine contractions. For this reason we use solutions that vary greatly in their concentration of Pitocin. It is our policy to start with a solution containing approximately 0.33 to 500 c.c. of dextrose in water. A two-bottle system is employed and the tubes from the glucose and the glucose-Pitocin solution join just before entering the needle. The glucose is started and then 1 to 2 drops of the Pitocin solution is introduced. If no reaction develops, 4 to 5 drops are introduced two to three minutes later, and, if still no reaction develops, the Pitocin solution is allowed to run at the rate of 5 drops per minute to test further the sensitivity of the uterus to the solution. This method of administration also makes it possible to detect the occasional instance of "pituitary shock." The rate of administration is then gradually increased up to 20 to 30 drops per minute. If satisfactory contractions do not ensue, the concentration of Pitocin in the solution is then increased gradually until a satisfactory uterine response is obtained. In some patients the uterus may be very refractory to the Pitocin and under such circumstances we do not hesitate to continue to add Pitocin to the solution. Occasionally we have employed as much as 4 to 8 c.c. during a single induction, while in the susceptible patient a small fraction of a cubic centimeter of Pitocin may be all that is required.

The authors have not stated the actual period of time during which their clinical experience was accumulated, nor other information such as the total number of patients with toxemia seen, the number of inductions, and the number of cesarean sections for this complication. During 1952 we had 249 patients with toxemia among a total of 4,595 pregnancies, making an incidence of this complication of 5.4 per cent. It is our policy to terminate pregnancy frequently in this complication, and yet only 5 cesarean sections were done for toxemia during 1952. Four of these patients were private and one was on the ward service. Four had severe pre-eclampsia and one of these had a previous cesarean section which may have modified the decision as to management. The one patient with mild pre-eclampsia had a congenital absence of one kidney and a bicornuate uterus which probably influenced the decision as to how the pregnancy should be terminated. During this same year there were 211 cesarean sections, so that toxemia as an indication for cesarean section occurred in a little over 2 per cent of our sections.

A review of our material for the year 1953 reveals an almost similar experience. Five patients were delivered by cesarean section because of the toxemia. These data lend support, then, to the idea advanced by the authors that pregnancy can be terminated prematurely when indicated by induction with Pitocin rather than by resort to cesarean

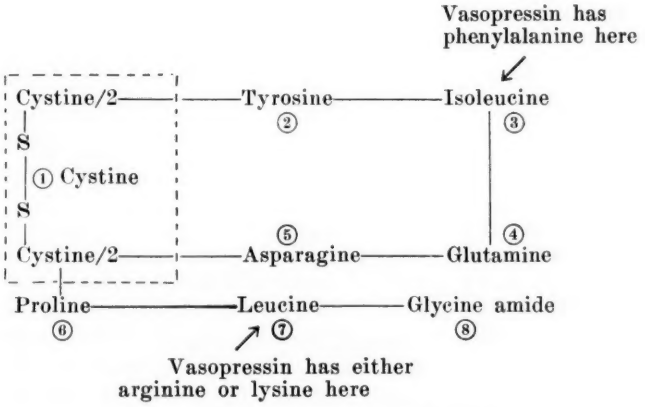
section. We do not hesitate to do a section if termination of pregnancy appears urgent, and we do not consider such patients obestetrical cripples after they are delivered. It is our practice to anticipate vaginal delivery in subsequent pregnancies where the indication is nonrecurrent.

Our interest in the hormones of the posterior pituitary has been increased in recent years by the fact that Dr. Vincent du Vigneaud, Professor of Biochemistry at Cornell University Medical College, has spent many years in characterizing and purifying the active principles of this gland. Recently he has succeeded in isolating as pure substance both oxytocin and vasopressin from the posterior pituitary gland. Now that the pure substances are available we shall be able better to determine their functions.

Let us consider for a moment just what Pitocin is. Dr. Parker has told you he has used it in a dilution of 1:2,000 or 0.25 c.c. per 500 c.c. The active principles in Pitocin are oxytocin and vasopressin. Both are solids when isolated. Before they were isolated their presence was determined by their physiological activity. Pitocin contains 10 units of oxytocin and less than 0.5 units of vasopressin in 1 c.c. of solution. Therefore, Dr. Parker is actually using 2.5 units of oxytocin and less than 0.125 unit of vasopressin per 500 c.c. of solution. Designating the concentration of oxytocin in terms of the units actually employed has merit if we consider that several ampules of a commercial preparation assayed by Dr. du Vigneaud were found to have an oxytocin activity of around 50 units per milligram of dry substance as compared with 500 units per milligram of dry substance for the purified oxytocin.

We have been fortunate to have had a supply of this purified oxytocin and have found that *unit* for *unit* it seems to be as effective as the commercially available oxytocin for inducing or stimulating labor (seven inductions and four stimulations). It must be remembered that 20 μg of the commercial preparation carries 1 unit of oxytocic activity while only 2 μg of the pure material are required.

Not only has Dr. du Vigneaud been able to isolate oxytocin, but he has more recently announced the synthesis of oxytocin. Oxytocin has the structure shown in the accompanying diagram. It is a polypeptide, composed of eight amino acids and three molecules of ammonia. Vasopressin (see diagram) has a structure much like oxytocin, except that vasopressin contains phenylalanine in place of isoleucine, and either arginine if isolated from beef pituitaries or lycine if from hog pituitaries in place of leuccine.



SCHEMATIC STRUCTURE OF OXYTOCIN

The oxytocin synthesized in the laboratory seems to be just as active *unit* for *unit* as the naturally occurring oxytocin for inducing (3 cases) or stimulating (3 cases) labor. At the moment, therefore, it seems that oxytocin without any vasopressin is effective in

inducing or stimulating labor. However, most of these patients have had favorable cervices. Those with unfavorable cervices in whom we have induced labor have received commercial preparations which contain some, albeit some amounts of, vasopressin.

It seems reasonably well demonstrated that the nonpregnant human uterus is more sensitive, i.e., contracts better, after vasopressin than after oxytocin. Similarly, the uterus in early pregnancy also is stimulated more by vasopressin than by oxytocin. The sensitivity of the uterus to oxytocin seems to increase as the pregnancy advances, being perhaps most sensitive to oxytocin at term. One is thus led to wonder if a proper mixture of oxytocin and vasopressin or, perhaps better, a course of vasopressin followed by a course of oxytocin might give better results in patients with toxemia, particularly those who are still some weeks from term like some of those discussed today by Dr. Parker. With the pure hormones available we may be able to get an answer to this question and possibly shorten the duration of the induction period.

ACUTE TOXEMIA OF PREGNANCY ASSOCIATED WITH ORGANIC HEART DISEASE*

With Observations on Myocardial Failure in Pre-eclampsia and Eclampsia

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ALTHOUGH there exists a voluminous literature dealing with heart disease in pregnancy, only sporadic comment is to be found concerning acute toxemia of pregnancy in the cardiac patient. It is probable, on the basis of physiological, pathological, and clinical observations, that specific hypertensive disease of pregnancy in women with organic heart disease is an extremely hazardous cardiovascular burden. Consistent with this view are recent data indicating that the load of established toxemia on the heart may be considerable in terms of increased cardiac work,[1] a situation which may precipitate congestive failure when the cardiac reserve is diminished by antecedent organic heart disease and by the physiological load of pregnancy. Moreover, the fact that the apparently normal heart may fail in severe pre-eclampsia-eclampsia further emphasizes the cardiac hazard of toxemia regardless of cardiovascular status.

In view of these considerations, the present report was undertaken as an attempt to define our experience with toxemia complicating cardiac disease. In addition, as an estimate of the significance of this problem in terms of maternal loss, we have reviewed 1,500 maternal deaths that have been reported and analyzed by the North Carolina Maternal Welfare Committee. It is hoped that our limited observations may stimulate further study of this rather neglected clinical problem.

Material

The records of all patients with the diagnosis of toxemia or cardiac disease at the North Carolina Baptist Hospital for the period Jan. 1, 1947, to Dec. 1, 1953, have been reviewed. The definitions and criteria of the American Committee on Maternal Welfare for the toxemias of pregnancy were employed as a basis for classification, and the distribution of patients in various categories of toxemia is shown in Table I.

In Table II are shown the cases in which definite evidence of organic heart disease was found either by history or by unequivocal physical findings. Attention is directed to the low incidence of valvular heart disease for this series as well as the limitation to rheumatic and congenital etiology.

*Presented, by invitation, at the Sixteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Hollywood Beach, Florida, Jan. 14, 15, and 16, 1954.

TABLE I. DISTRIBUTION OF PATIENTS ACCORDING TO TYPE OF TOXEMIA

I. Acute Toxemia of Pregnancy.—		
a. Pre-eclampsia	594	
b. Eclampsia	21	
Total		615
II. Chronic Hypertensive (Vascular Disease With Pregnancy).—		
a. Chronic hypertensive vascular disease without superimposed acute toxemia	76	
b. Chronic hypertensive vascular disease with superimposed acute toxemia	21	
Total		97
III. Unclassified Toxemias	5	5
Total toxemia		717
Hospital discharges (term and premature delivery, abortion)	8,707	
Incidence of toxemia	8.2 per cent	

TABLE II. INCIDENCE OF ORGANIC HEART DISEASE, NORTH CAROLINA BAPTIST HOSPITAL, 1947-1953

Rheumatic valvular disease	46
Congenital heart disease	6
Total	52
Incidence of organic heart disease	0.6 per cent

Cases of organic heart disease are given in Table III with reference to the occurrence of toxemia of pregnancy. Although the series is small, the finding of the expected 2.6 per cent cardiac disease incidental to toxemia is in sharp contrast to the 36.5 per cent incidence of toxemia in patients with organic heart disease. Of the patients with rheumatic heart disease who developed toxemia, congestive failure occurred in 2, but response to digitalis was satisfactory. An additional 8 cardiac patients with toxemia were digitalized prophylactically and congestive failure did not develop. Five other patients received no digitalis and remained compensated. No fatalities occurred in this group. Of the 2 patients with congenital heart disease who had toxemia, one was digitalized with the onset of failure (Case 1).

TABLE III. INCIDENCE OF ORGANIC HEART DISEASE COMPLICATED BY TOXEMIA, NORTH CAROLINA BAPTIST HOSPITAL, 1947-1953

		WITH TOXEMIA	WITHOUT TOXEMIA
Rheumatic heart disease		17	29
Congenital heart disease		2	4
Total toxemia	717		
Incidence of organic heart disease in toxemia			2.6 per cent
Incidence of toxemia complicating organic heart disease			36.5 per cent

TABLE IV. NORTH CAROLINA COMMITTEE ON MATERNAL WELFARE ANALYSIS OF 1,500 MATERNAL DEATHS, 1946-1953

Toxemia of pregnancy, primary	393	26.2 per cent
Pulmonary edema	115	29.2 per cent
Shock syndrome with pulmonary edema	20	17.4 per cent
Cardiac disease, primary	61	4.1 per cent
Toxemia contributing to cardiac disease	14	23.0 per cent

In analyzing the causes of maternal loss from information obtained by questionnaire, the North Carolina Committee on Maternal Welfare attributed

393 of 1,500 deaths primarily to toxemia of pregnancy. In 115 of these cases, pulmonary edema was believed to be the essential terminal factor involved, an incidence of 29.2 per cent. Sixty-one deaths were attributed primarily to cardiac disease, with toxemia a significant contributing factor in 14, or 23 per cent. These data are shown in Table IV.

The following case reports have been selected as illustrative of the factor of toxemia as it bears on the development of heart failure in the patient with organic heart disease.

CASE 1.—(NCBH No. 54438) The patient, a 22-year-old primigravida, was first admitted to the North Carolina Baptist Hospital at 30 weeks' gestation because of hypertension and albuminuria. She was known to have congenital heart disease of undiagnosed type and throughout her life had experienced dyspnea and variable degrees of cyanosis on slight physical exertion. There was no history of previous congestive heart failure and her prenatal course was normal until one week before admission when the blood pressure was recorded as 150/98. On admission the patient was quite comfortable and in no apparent difficulty. The blood pressure was recorded as 152/94. The heart was not enlarged to percussion, but a faint palpable thrill was present over the base and a short harsh systolic murmur could be heard at the apex and along the left sternal border. The lungs were clear and no edema was demonstrated. The nail beds were faintly cyanotic and minimal clubbing of the finger tips was present. No enlargement of the liver or spleen was detected. The uterine enlargement was consistent with 30 weeks' gestation. Laboratory findings were not remarkable except for the fact that a catheterized urine specimen showed a trace of albumin. An electrocardiogram showed only right axis deviation and fluoroscopic and radiographic examination of the chest showed the heart to be at the upper limits of normal size with increased fullness in the pulmonary region. A cardiologist was of the opinion that the lesion probably represented an Eisenmenger complex.

On bed rest, salt restriction, and a high-protein diet, the blood pressure stabilized within 48 hours at 120 to 130 systolic and 80 to 90 diastolic and the patient was discharged on the ninth hospital day to be followed weekly in the outpatient department. Bed rest was advised at home except for meals and salt limitation was prescribed. Prophylactic digitalis was not given.

The patient returned to the outpatient department one week after discharge without complaints. The blood pressure was 140/100 and a voided urine specimen showed a trace of albumin. One week later the blood pressure was 150-160/98-108 and 3 plus proteinuria was present. She stated that she had had generalized headache for several days and had fainted on one occasion when she was ambulatory, but appeared to be in no acute distress. On readmission to the hospital at this time the cardiac findings were unchanged and the lungs were clear. No hepatomegaly or splenomegaly was noted, although 1 plus sacral edema was present. The blood uric acid concentration was 6.3 mg. per cent.

Hypertension persisted at levels between 130-155/90-110 and the albuminuria was consistently 3 to 4 plus but the patient received no sedation. Prodromal labor began spontaneously on the fourth hospital day, when the patient suddenly became markedly dyspneic and cyanotic and her pulse rate which had previously been normal increased to 102 per minute. Oxygen was administered and prophylactic digitalization begun although no evidence of failure was apparent on examination. At this time morphine, ¼ grain, was given. On the following day, the patient suddenly developed acute pulmonary edema, tachycardia, and cyanosis, but response to aminophylline and oxygen was satisfactory. The blood pressure was recorded as 130/90. On the sixth day a third acute cyanotic episode occurred, but responded well to oxygen. At this time the uterus was tense and the fetal heartbeat could not be heard. Slight fresh vaginal bleeding was noted. Six hours later the terminal attack of dyspnea and cyanosis began in association with mental confusion. Moist râles were present in the lung bases. In spite of positive pressure oxygen and aminophylline the patient did not respond, and died from cardiorespiratory failure.

At autopsy a uterine pregnancy was found, undelivered, of approximately 36 weeks' duration, and abruptio placentae. Examination of the heart showed an Eisenmenger complex with a high interventricular septal defect, dextroposition of the aorta, and right ventricular hypertrophy with dilatation of the pulmonary artery.

Comment.—In spite of hospitalization and adequate treatment of heart failure, the perilous condition of this patient was apparently not fully appreciated as evidenced by the rather casual management of the toxemia. Perhaps the final outcome might not have been altered, but earlier hospitalization and more vigorous therapy of the mild pre-eclampsia would certainly have been desirable.

CASE 2.—(NCBH No. 103061) A 19-year-old primigravida was admitted with ruptured membranes, not in labor, at 35 weeks' gestation. The patient was known to have rheumatic cardiac disease and had developed congestive failure at 28 weeks. She was hospitalized for one week at that time and digitalized, was discharged on maintenance digitoxin, ammonium chloride, salt-poor diet, and was advised to remain at bed rest.

Examination on admission showed the blood pressure to be 160/88, pulse 88, and respirations 20. The heart was enlarged to the left and rhythm was grossly irregular. A Grade III blowing systolic murmur was present at the apex together with a short diastolic murmur. Dullness of lung bases was present bilaterally with showers of râles present. One plus tibial edema and 2 plus sacral edema were present. The hemoglobin concentration was 9.5 Gm. per cent and the urine contained a trace of protein. The congestive failure was treated by oxygen, Digalen, and Thiomerin with equivocal response.

Labor began spontaneously shortly after admission and after 15½ hours the patient was delivered of a viable 5 pound, 4 ounce male infant by low forceps under spinal anesthesia. Moderate pulmonary congestion persisted through labor and delivery, but cleared by the third postpartum day. The blood pressure stabilized at normotensive levels by the first postpartum day, and the patient was discharged, improved, on the sixth day following delivery.

Comment.—This case is of some interest in that despite good medical management and digitalization from the twenty-eighth week, cardiac decompensation developed in association with pre-eclampsia. The anemia, although not marked, may have been a contributory factor in the development of failure. The toxemia was apparently not seriously considered as no effort was made to control it. Fortunately, the patient made a satisfactory recovery.

CASE 3.—(NCCMW No. 1133) A 33-year-old white para i, gravida ii, was a known chronic rheumatic fever patient of many years' duration. Although her first pregnancy was uncomplicated, she was advised against a second pregnancy because of her cardiac status. The early prenatal course was not complicated except for rather severe nausea and vomiting until the fifth month when marked edema developed. At this time interruption of pregnancy was advised by her physician but was refused. Early in the sixth month her blood pressure had increased from normotensive levels to 160/95 and 2 plus proteinuria was present. She was immediately hospitalized and the toxemia was treated by sedation, magnesium sulfate, concentrated glucose, and "alkalies." At this point the patient changed her mind about interruption of pregnancy and hysterotomy, tubal ligation, and appendectomy were carried out. Although the patient's immediate postoperative course was satisfactory, she died suddenly on the fourth postoperative day in acute congestive failure. There was no autopsy.

Comment.—In addition to acute toxemia and heart disease, trauma undoubtedly was a significant factor in this patient's demise. The administration of "alkalies," probably sodium salts, was certainly not desirable.

CASE 4.—(NCCMW No. 1233) A 36-year-old white para i, gravida ii, developed hypertension without proteinuria in the thirty-fourth week of pregnancy. Prior to this her prenatal course had been normal. She was immediately hospitalized, admission blood pressure being 160/100. A definite history of rheumatic fever in childhood was obtained, but recovery had apparently been satisfactory with no significant functional impairment. Her first pregnancy was uncomplicated, but because of chronic rheumatic valvular disease a second pregnancy was not advised. Interruption of this pregnancy was refused. One week following

hospitalization and 6 to 7 days before death the patient developed a slight temperature elevation and *Streptococcus viridans* was cultured from the blood. In spite of massive doses of penicillin and digitalization the patient's condition deteriorated, and she died undelivered in the thirty-sixth week of gestation.

Comment.—Although the extent of the bacterial endocarditis is not known, the infection itself may have been a decisive factor in determining the outcome of this case.

CASE 5.—(NCCMW No. 1192) The patient was a 36-year-old Negro para viii, gravida ix, who was first seen by a physician in the seventh month of pregnancy. At that time the blood pressure was 160/110. A definite history of rheumatic heart disease with mitral and aortic valvular involvement was obtained. At a prenatal visit in the eighth month the blood pressure was still found to be 165/100, and two weeks later 180/100. A low-salt diet and phenobarbital were prescribed but the hypertension persisted. No proteinuria was demonstrated. Early in the ninth month the membranes ruptured spontaneously but labor did not ensue. Penicillin was given prophylactically for three days after which labor occurred spontaneously. A stillborn infant was delivered by version and extraction. No evidence of bleeding was noted. The patient died suddenly three hours following delivery. No autopsy took place.

Comment.—The serious condition of this patient was obviously not fully appreciated as she was managed at home throughout her course. Treatment of the toxemia was inadequate. Chloroform anesthesia as well as operative delivery in the home are undesirable even in the uncomplicated case.

Comment

The physiological burden of pregnancy on the cardiovascular system has been the subject of a number of quantitative clinical and laboratory investigations which have firmly established the fact that the work of the heart under basal conditions is significantly increased by gestation.[2, 3, 4, 5] In addition, cardiac work in terms of output appears to be exaggerated in comparison with the nonpregnant response to various levels of physical effort above basal activity,[6] the normal "load of pregnancy" on the heart thus consisting of an activity as well as a basal component. As is well known, this normal burden may prove excessive for the badly damaged heart and may be productive of myocardial decompensation.

However, the physiological load is not the only factor that the obstetrician must consider in the management of the cardiac patient, for abnormal burdens may develop during pregnancy which may further jeopardize cardiac compensation. Among the common conditions that may be responsible for further loading of the myocardium are anemia, obesity, and infection[7, 8, 9] as diagrammed in Fig. 1. Finally, specific hypertensive disease of pregnancy must be included as a particular hazard for the cardiac patient, as emphasized by a number of authors.[10, 11, 12, 13] This increased cardiac risk is to be expected on the basis of data from diverse sources. Although Hamilton and Thomson[14] on clinical grounds question the identity of congestive failure and acute pulmonary edema in toxemia, organic heart disease is not a prerequisite for the development of this complication. Teel, Reid, and Hertig[16, 17] consider left ventricular failure to be the basic physiological mechanism involved and point out the high incidence of acute pulmonary edema in eclampsia as well as its occurrence in severe pre-eclampsia without evident antecedent cardiac disease. The frequent occur-

rence of this complication in fatal cases of toxemia is also pointed out by Dieckmann.[15] The development of pulmonary edema without evidence of systemic venous congestion, frequently in association with peripheral signs of shock (17.4 per cent in our series), is not necessarily a cardiovascular peculiarity of toxemia, but seems comparable to "cardiac shock" occurring in myocardial infarction[18] and in acute failure in other hypertensive states[19] where the dominant signs are referable to decreased output of the left ventricle. The finding of acute pulmonary edema in 29.2 per cent of the maternal deaths attributed primarily to toxemia by the North Carolina Committee on Maternal Welfare again emphasizes the potential risk to the myocardium in this disease.

Pertinent to the problem of myocardial strain or failure are the recent observations of Hamilton[1] who reported a significant increase in the cardiac output in the majority of pre-eclamptic patients who exhibit hypertension, edema, and albuminuria. In two-thirds of these patients the increment in cardiac output above the expected normal level for the stage of gestation attained was moderate but in certain cases marked increases were observed. It is of interest that the cardiac output of patients who had chronic hypertension with superimposed toxemia was invariably increased. These data suggest the probable large contribution of the altered cardiovascular dynamics in severe toxemia to the development of myocardial failure when the known direct relationship of cardiac output and peripheral resistance to cardiac work is considered.[20]

Of possible significance in the etiology of failure in the severe toxemias is direct myocardial injury of vascular derivation. Although pathological change in the heart is not consistently observed, Dieckmann[15] estimates the incidence of petechial hemorrhages and focal necrosis in the myocardium to be 40 to 60 per cent, and significant histological changes in the heart have been described by a number of authors.[17, 21, 22]

Few electrocardiographic observations have been reported in the acute toxemias, but the occurrence of significant changes appears to be irregular. Thus, Wallace and his co-workers[23] described electrocardiographic changes suggestive of myocardial infarction in 2 cases of pre-eclampsia associated with congestive heart failure. In 4 other cases without failure, changes interpreted as significant were observed, but in six additional pre-eclamptic patients no apparent electrocardiographic abnormality was found. These authors suggested that focal necrosis and edema of the myocardium in certain cases of toxemia may be responsible for ECG changes. Similarly, Szekely and Smith[24] concluded that the electrocardiographic changes they observed in 4 out of 19 pre-eclamptic patients might be related to myocardial injury resulting from the toxemia and they suggest that the postpartum vascular collapse encountered in the acute toxemias may be based on cardiac damage secondary to the disease. On the other hand Eufinger and Molz[25] were unable to demonstrate significant ECG changes in 23 cases of toxemia including 6 of eclampsia, and Hamilton and Thomson[14] failed to find convincing electrocardiographic evidence of myocarditis in a single uncomplicated case of toxemia that they studied.

Clarification of this problem requires further study with reference to the factor of duration as well as severity of the toxemia required for the evolution

of abnormal electrical potentials which may parallel the development of myocardial injury. Although electrocardiographic evidence of cardiac damage is not consistently demonstrable, the possibility of significant alterations in myocardial physiology emphasizes the necessity of careful observation of the cardiac patient with toxemia for changes in functional status of the heart.

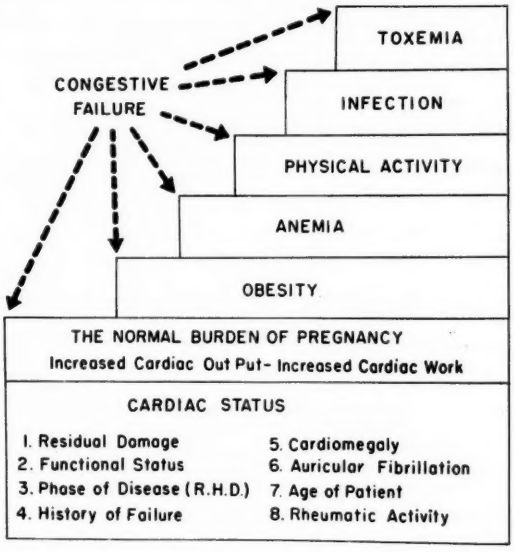

Fig. 1.—Possible factors contributing to myocardial failure with organic heart disease.

Few data are available bearing on the incidence of toxemia of pregnancy in patients with valvular heart disease. Hamilton and Thomson,[14] however, concluded that cardiac patients are not more susceptible to toxemia than are women without heart disease, an opinion also held by Jensen[26] and by Gordon and associates.[10] On the other hand, F. G. Jensen[27] reported hypertension and albuminuria in 19 of 71 patients with rheumatic heart disease, the toxemia occurring more frequently in patients who had several attacks of rheumatic fever, particularly when the last acute episode occurred shortly before pregnancy.[27] Toxemia was also found to be a rather common complication of congenital heart disease by Lund[28] who pointed out its seriousness in this condition, but such frequency of association was not found by Kerr and Sodeman.[29] Although our hospital series is small, the occurrence of toxemia in more than one-third of the patients with valvular heart disease is suggestive of a possible relationship between these conditions and needs further scrutiny of the problem by other clinicians. Of interest, and of possible significance, is the relatively frequent occurrence of toxemia as a contributory factor in maternal deaths attributed primarily to organic heart disease in North Carolina. This observation directs attention to the necessity not only of meticulous observation for any evidence of change in the functional status of the pregnant cardiac patient, but also of particular effort directed at prevention and immediate treatment of toxemia.

Deserving of comment is the low incidence of organic heart disease for the obstetrical service of the North Carolina Baptist Hospital which is at variance

with the published hospital incidence of 1.5 to 3.0 per cent of various authors.[30, 31, 32, 33] Although a number of interpretations are possible, our figure of 0.6 per cent is not readily explained by rarity of rheumatic heart disease in Western North Carolina where the autopsy incidence of rheumatic carditis has been reported as greater than that of other areas of the United States.[34] The establishment of the diagnosis of rheumatic heart disease in pregnancy may be difficult, and it seems probable that our parameter of suspicion has not been inclusive enough, cases being overlooked because of minimal physical signs or indefinite cardiac histories. Such diagnostic errors may be clinically significant not only because of the abrupt changes in cardiac functional status that may occur in association with pregnancy, but also because of the possible increased risk of toxemia in women with valvular heart disease.

Summary

1. The data presented suggest an increased frequency of association between organic heart disease and toxemia.

2. The cardiovascular burden of toxemia is a serious risk to women with organic heart disease as evidenced by the not infrequent contribution of toxemia to mortality in cardiac patients.

3. Attention is directed to the obvious bearing of these observations on the prenatal care of patients with heart disease.

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Discussion

DR. MASON ANDREWS, Norfolk, Va.—This paper makes an important contribution to maternal welfare by emphasizing and documenting the danger of a predictably undesirable combination of complications of pregnancy. Because of the rarity of such a combination in the experience of any individual, it is well to be forewarned to put forth greater efforts to prevent toxemia in cardiac patients and, when it occurs, to deal courageously with it, including early and prolonged hospitalization.

The most impressive new information to emerge from this study is the 36.5 per cent incidence of toxemia among cardiac patients in the authors' material. Excluding their patients with chronic hypertension (if their general rate obtained), about 32 per cent of their cardiac patients probably developed acute toxemia.

I believe most workers in obstetrical cardiac clinics have not been impressed with any unusually high incidence of toxemia. Aside from the small proportion which are cases of congenital heart disease, Hamilton is the only author in this country to my knowledge who has actually reported the incidence of toxemia in all cardiac patients. His figure in 1942 in a large series was 9.3 per cent, which was the clinic average. Between these two apparently conflicting reports it would be interesting to know the actual experience elsewhere.

The IBM punch cards at the Johns Hopkins Hospital accurately coded by experienced residents reveal the following pertinent information. Among 12,339 deliveries from 1946 to 1950, there were 268 patients with organic heart disease (2.2 per cent) and 11.9 per cent of these developed acute pre-eclampsia. There was no eclampsia. This is definitely above the clinic average there for pre-eclampsia, but far below 32 per cent.

It is quite possible that the apparently conflicting reports come about because of differing degrees of prenatal care. Hamilton's figures refer to patients, almost all white, who regularly visited a special clinic attended by expert cardiologists and obstetricians. They generally cooperated with the meticulous care they received. His figures are from his cardiac clinic only. Today's paper reports all hospital admissions at the North Carolina Baptist Hospital during the period studied. They must have had differing degrees of prenatal care; possibly many were Negro patients, and probably many patients had various degrees of self-imposed neglect. The experience at Hopkins has elements of both extremes but the bulk of them regularly attended a special cardiac clinic.

Theoretically, one would expect cardiac disease to increase the incidence of pre-eclampsia and to make it more severe and more hazardous when it occurs, as would any situation which increases sodium retention. Sodium retention is a basic process in both pre-eclampsia and chronic cardiac disease and apparently occurs at the same site—and even possibly by a similar mechanism. In both these situations, excluding terminal failure and terminal eclampsia, renal blood flow and glomerular filtration are rather normal, and apparently the proximal renal tubule is responsible for decreased sodium clearance, probably by increased reabsorption of sodium. Newman has shown that even mild exercise causes sodium retention by this mechanism in both normal and cardiac patients. This retention is greater in the patient with cardiac disease. We know empirically that exercise increases evidence of sodium retention in the pre-eclamptic patient and that bed rest decreases it. There has been much suspicion among cardiac physiologists that sodium retention in cardiacs is mediated hormonally, possibly by a steroid hormone, possibly from the adrenal.

In severe pre-eclampsia, the serious burden placed on a normal heart has been clearly stated here. In addition to the increased peripheral resistance and increased cardiac output, it seems clear both from ECG and autopsy evidence that blood supply to the cardiac muscle may be significantly impaired by the vasospasm. This is rather generally accepted. A diseased heart can ill afford these additional burdens.

The evidence quoted by this paper concerning the 5 per cent of obstetrical cardiac patients who have congenital lesions is rather convincing that the danger of pre-eclampsia is even greater than with heart disease of rheumatic origin. In addition to the dangers just described, the danger of death from immediate postpartum vascular collapse, common to all cardiac patients, seems much greater where congenital lesions exist, possibly due to accentuated adverse flow through A-V shunts. All of the authors quoted report at least one such death in small series.

The author raises the question of the discrepancy between the incidence of cardiac disease among his patients and that in the literature. Two years ago at this meeting a 0.34 per cent incidence was reported from the Medical College of Virginia and 0.5 per cent from the Grady Hospital in Atlanta. All of the incidence figures referred to in the present paper were obtained from northern clinics. Referred cases to the various centers may explain a part of the discrepancy but it still seems that our Southern stethoscopes are less sensitive or the Southern sunshine more healthy. I prefer to believe the latter, though possibly both factors apply.

DR. JOSEPH COUDON, Jacksonville, Fla.—It is remarkable that in Dr. Burt's series of cases of definite heart disease the incidence of valvular heart disease is so low. The incidence of heart disease of all types among pregnant women varies according to various authors from 1.5 to 3 per cent. In 850 cardiac cases found among 48,190 consecutive cases of labor at the Boston Lying-in Hospital, Hamilton and Thompson found that 92 per cent had rheumatic heart disease (781 cases); 28 had congenital heart disease (patent ductus arterious, intraventricular septal defects, coarctation of the aorta, etc.); 2 had cardiovascular syphilis; and 39 had miscellaneous afflictions such as acute bacterial endocarditis, hypertensive cardiovascular disease, and cardiac arrhythmias. Mitral stenosis accounted for 68.4 per cent—mitral stenosis plus associated lesions 83.3 per cent.

Lavine in his book on clinical heart disease lists the types of organic heart disease as: (1) cardiac arrhythmias, (2) congenital heart disease, (3) syphilitic heart disease, (4) acute bacterial endocarditis, (5) hypertensive cardiomuscular disease, (6) rheumatic heart disease.

He then states that there are other rarer forms of heart disease in which the prognosis may be excellent despite a considerable degree of heart failure because present-day treatment is so effective, including toxemia of pregnancy.

Hamilton and Thomson list as the chief cause of death among pregnant patients with cardiovascular disease congestive heart failure 56.1 per cent, sepsis 14.6 per cent, pulmonary edema 12.2 per cent, shock and hemorrhage 4.9 per cent, toxemia of pregnancy 4.9 per cent, bacterial endocarditis 4.9 per cent, and toxic hepatitis 2.4 per cent.

Some of Dr. Burt's discrepancies may be explained by the fact that there is a considerable group of normal pregnant women in whom as pregnancy develops symptoms and signs appear which suggest the presence of heart disease. These patients must be carefully evaluated and managed accordingly.

From Dr. Burt's series of cases, one would conclude that the pregnant patient with organic heart disease is more likely to develop toxemia. Very few data, however, are available bearing on the incidence of toxemia of pregnancy in patients with valvular heart disease. There seems to be a difference of opinion as to whether the cardiac pregnant woman is more susceptible to the development of toxemia or not.

The finding of acute pulmonary edema as the essential terminal factor in 115 of 393 maternal deaths attributed primarily to toxemia by the North Carolina Committee on Maternal Welfare certainly emphasizes the potential risk to the myocardium in this disease. It also emphasizes that when a pregnant woman with a possible cardiac problem comes for examination the physician must immediately recognize that here is a challenge to be met requiring keen judgment and careful observation.

It is not uncommon for women in the childbearing age to have heart murmurs. One must be certain that such a murmur is not functional since these are of no significance and

will cause no difficulty. If one cannot be certain by careful auscultation whether a murmur is functional or organic, careful study will usually help in the decision. If the murmur is diastolic or presystolic, it is organic. If accentuated by exercise or if an apical murmur is accentuated when the patient is lying on her left side it is more likely to be organic than functional. Loud murmurs are usually organic—soft murmurs are more likely to be of no significance. The size of the heart is determined by percussion and x-ray examination, including fluoroscopy, which may be valuable aids in arriving at a final conclusion. Enlargement of the left auricle as seen during fluoroscopy may be the first clue to a diagnosis of rheumatic mitral endocarditis. The electrocardiogram in this type of problem is unlikely to contribute conclusive evidence. The patient's history may be of invaluable aid. A story of childhood rheumatic fever, diphtheria, scarlet fever, or repeated episodes of sore throat must be carefully evaluated. The story of a murmur or of cardiac disability in infancy alerts one to the possibility of a congenital lesion. The history of syphilis in early youth, the presence of myxedema, chest deformities, hypertension, or true anginal pain are factors of obvious importance. The history of an episode of congestive heart failure is of extreme importance.

According to Page, in the presence of essential hypertension in the pregnant patient before the fourth lunar month, somewhat less than one-third of the patients may develop preeclampsia or eclampsia after the sixth month. Prognostically, one can state that the patient with essential hypertension has a 50 to 70 per cent chance of passing through pregnancy without difficulty. The incidence of toxemia is about 30 per cent. If the hypertension is severe and cardiac enlargement is present, the maternal mortality may be increased to as high as 10 per cent.

EXPERIENCES WITH VAGINAL HYSTERECTOMY*

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THE purpose of this paper is to present our personal experiences with an expanding concept of vaginal hysterectomy. The influence of Heaney and Allen of Chicago, Counseller of Rochester, and Campbell of Montreal, among others, has led us to accept and take part in this trend. An operation once regarded as primarily a procedure for procidentia has been advocated as the procedure of choice to correct at any age many of the more difficult gynecological surgical problems. The practicality of the vaginal approach, when there is either uterine descent or need of extensive plastic surgery, is obvious. However, it has been my observation that in the region of the South Atlantic Association of Obstetricians and Gynecologists this procedure is not generally utilized in its larger scope and our Fellows have possibly been loath to leave the surgical techniques of their earlier training and experience, still employing vaginal hysterectomy primarily for the more severe degrees of uterine prolapse.

For that reason we are here presenting 184 consecutive operations of vaginal hysterectomy upon white private patients from our practice from which certain experiences have been acquired. It is not the purpose of this paper to present any striking innovation in the vaginal approach to pelvic surgery, nor to review the history or anatomical considerations of vaginal hysterectomy, nor to debate the relative merits of vaginal versus abdominal hysterectomy.

Suffice it to say that the operation has not caused abdominal hysterectomy to be discarded in our clinic. Vaginal hysterectomy has not been used as a trick operation to test surgical acumen and continues to constitute a minor portion of our gynecological surgery. As a general rule only cases requiring some degree of pelvic repair have been approached vaginally and the indications for the hysterectomy have been clear-cut. Our experience has been that the combination of hysterectomy and repair offers the advantage of excellent vaginal reconstruction with eradication of either the pathological or abnormally functioning uterus, or the symptomatic uterus whose reproductive function has been served. The same excellence of result frequently cannot be obtained by laparotomy associated with vaginal repair.

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Over the past decade a measure of confidence, born of increasing experience, has been acquired that has led us to approach per vaginam more difficult problems, including degrees of pelvic pathology that formerly would have been handled by laparotomy. As a result the incidence of complete prolapse in these cases has accordingly lessened. Likewise there has been a marked decline in the utilization of the Manchester operation, which has been primarily reserved for cases where possibly another child might be desired or utilized for descensus in younger women whose uteri we are still loath to remove.

Age Incidence

It is noted that 38 per cent of these patients were over 50 years of age (Table I). Eight patients were over 70 years of age, the oldest being 78. Our criteria for surgery in the postmenopausal group have been symptoms or disability sufficient to justify the surgery. It is well known that postmenopausal patients may have pelvic relaxation for many years without symptoms. One patient with a complete prolapse and inversion of the vaginal vault managed a very adequate existence for a period of 20 years by daily inserting in the vagina a wad of raw field cotton. This afforded satisfactory support and the cleanness of the vaginal mucosa and the lack of all excoriation testified to the innocuousness of this practice. Our general attitude toward the postmenopausal patient with descensus and relaxation but free of symptoms has been one of nonoperative observation.

TABLE I. AGE INCIDENCE

	NO. OF CASES
Under 30 years	5
30-39 years	50
40-49 years	58
50 years and over	71
Total	184

It has also been our observation that a rapidly progressive prolapse, enterocele, cystocele, and rectocele may develop in a late postmenopausal patient who heretofore has been completely free of gynecological symptoms. While loss of weight, debility, diabetes, degenerative vascular disease, or prolonged illness may be contributing factors in this loss of fascial support, more frequently there is no obvious explanation. In this field of geriatric surgery the gynecologist will find increasing opportunity for development of his judgment and talent as prolongation of life expectancy brings greater numbers of our women to this age of life. In our series of operations there were 71 postmenopausal patients. By coincidence there happened to be 71 patients 50 years of age or over.

Only 5 patients (2.7 per cent) were under 30 years of age. Our younger patients are encouraged to postpone elective plastic procedures until childbearing is considered complete. By conservative office therapy and efforts to aid the psychosomatic and environmental problems that so frequently are present in the young woman with gynecological symptoms, elective procedures in this age group may frequently be postponed. In fact, time and general constitutional improvement may minimize the pathology to such an extent that surgery may be no longer indicated. However, should symptoms and pathology continue to necessitate plastic repair in the very young women (21 to 29 years) the Manchester-Fothergill operation is usually our procedure of choice.

Symptoms

Subjective symptoms, occasionally incapacitating in nature, were sufficiently severe to necessitate corrective surgical procedures in the great majority of these patients. Symptomless pelvic relaxation per se has seldom been regarded as an adequate indication for gynecological surgery.

In this series of 184 vaginal hysterectomies, symptoms of pelvic pressure were present in 132, or 71 per cent of the cases, while visible protrusion from the vagina of either the cervix or the anterior vaginal wall was present in 97 patients (Table II). Urinary incontinence was a chief complaint in 35 patients. This symptom varied in degree from incontinence only under stress to the more severe forms of urinary insufficiency.

TABLE II. SYMPTOMS

	NO. OF CASES
Pelvic pressure	132
Protrusion	97
Incontinence	35
Bleeding	33
Dyspareunia	9
Dysmenorrhea	11

Vaginal bleeding was a complaint in 18 per cent of the total cases while bleeding was the only complaint or symptom in 5 cases. Dyspareunia or dysmenorrhea was noted as a chief complaint in approximately 10 per cent of the cases. One patient was free of all pelvic symptoms, though she had rheumatic heart disease and a badly diseased cervix and rectocele, and a history of both habitual and therapeutic abortions.

Associated Pathology

The chief pathology in this series consisted of some form of inadequate pelvic support (Table III). Cystocele and/or rectocele were noted in 175 cases, descensus uteri in 115 cases, prolapse in 45 cases, and enterocele in 31 cases. Uterine fibroids, enlarged sufficiently to be noteworthy, were present in 36, or 20 per cent of the cases. A difficult morcellation operation was employed in 6 of these cases. The 5 cases of carcinoma and the 2 pregnancies noted were coincidental findings.

TABLE III. ASSOCIATED PATHOLOGY

Fascia Inadequacy.—	
Cystocele and/or rectocele	175
Descensus uteri	115
Prolapse	45
Enterocele	31
Intravaginal.—	
Extensively diseased cervix	52
Intraepithelial carcinoma of cervix	4
Third-degree laceration	3
Abdominal.—	
Uterine fibroids	36
Adenomyosis	10
Ovarian cyst	7
Adenocarcinoma of fundus	1
Ectopic pregnancy	1
Uterine pregnancy	1
Medical Complications.—	
Hypertensive cardiovascular disease	18
Diabetes	4
Rheumatic heart disease	1

Previous Pelvic Surgery

A total of 37 patients (20 per cent) had undergone 47 previous gynecological operations prior to our surgery (Table IV). The majority of these procedures had been performed for symptoms and pathology which were not relieved by the surgery employed. These operations included 10 vaginal plastics, 14 uterine suspensions, 11 pelvic laparotomies in which suspension may or may not have been included, 2 radiation cases, two previous pelvic laparotomies upon 2 patients, and three previous gynecological laparotomies upon 2 patients.

TABLE IV. PREVIOUS PELVIC SURGERY (20 PER CENT)

	NO. OF CASES
Vaginal plastic	6
Pelvic laparotomy	11
Uterine suspension	10
Vaginal plastic and abdominal suspension	4
Two pelvic laparotomies	2
Three pelvic laparotomies	2
Radiation therapy	2

The surprisingly high incidence of previous surgery here noted is a thought-provoking warning of the possible end result of an inadequate procedure or of a poorly chosen operation. The wave of recrimination against the medical profession that has recently swept through the lay press in an effort to prevent the unnecessary hysterectomy might well be counterbalanced by a plea for the indicated and justified hysterectomy. These 37 cases demonstrate that failure to accomplish adequate surgery may leave an incapacitated or complaining patient who faces eventually the dangers of subsequent pelvic operations.

We would emphasize that a previous pelvic laparotomy, while a warning of possible technical difficulty, should not of itself be considered a contraindication to vaginal hysterectomy. Attention should particularly not be diverted from the vaginal approach in such cases when the gynecological pathology includes symptomatic or extensive pelvic relaxation. Many of these patients can best be restored to a normal life by both repair and uterine extirpation. Lack of recognition of this fact accounts for many operative failures as inadequate surgery may be a factor in the development of the habitual gynecological cripple and chronic complainer.

In one case we were unable to remove the uterus because of a previous ventral fixation. The cervix was thereupon amputated, the vault closed and supported, and the repair accomplished. Following this the uterine fundus, intimately attached to the anterior abdominal wall, was removed by laparotomy. This case has been included in our series as a failed vaginal hysterectomy, although the end result of the surgery was entirely satisfactory.

TABLE V. OPERATIONS (184 CASES)

Vaginal hysterectomy only	9
Vaginal hysterectomy and repair	174
Failed vaginal hysterectomy	1
Enterocele repair	32
Salpingo-oophorectomy	14
Salpingectomy	5
Morcellation	6

Type of Operation and Secondary Operations

On only 9 patients was vaginal hysterectomy performed without plastic repair (Table V). An enterocele repair was performed in 32 cases, salpingo-oophorectomy in 14 cases, and salpingectomy only in 5 cases. Morcellation of uterine fibroids was necessary in 6 cases.

Technical Procedures

In general our technical approach has followed accepted patterns, namely, early invasion of the anterior and posterior cul-de-sacs, ligation of the utero-sacral ligaments, ligation of the parametrial bases and broad ligaments, and eventually the uteroovarian anastomosis. During this stage of the operation interrupted lock sutures of No. 0 or 1 chromic catgut have been employed, and we have found this transfixing type of suture to be of distinct value in operating efficiency. Difficulty during this portion of the operation may be avoided by refraining from the temptation to turn the uterine fundus out prematurely. Better exposure and suturing of the parauterine tissue is likewise obtained by lateral traction on the cervix, usually until the last Heaney clamp is placed over the tube and uteroovarian anastomosis.

Following extirpation of the uterus, we have employed three general variations of peritoneal closure and vaginal vault reconstruction. The first of these, used in 104 cases, consists of prompt peritoneal closure, usually with a circular suture, bringing the round and broad ligament pedicles outside the peritoneum. Subsequent support is established by uterosacral plication, pubocervical plication, and suture of uterosacral ligaments to the pubocervical fascia laterally. Wherever the vaginal vault is quite relaxed and its eversion is a potential hazard the attenuated uterosacral ligaments have been sutured anteriorly to the fascia and also to each other.

The second variation of closure which we have employed in 44 cases follows closely the technique of Heaney and Allen. Sutures are placed in the lateral fornix incorporating mucosa, pubocervical fascia, anterior peritoneum, round ligament pedicle, posterior peritoneum, uterosacral ligament, and lateral vaginal mucous membrane. Additional anteroposterior sutures are subsequently used, which close the vaginal vault with an excellent support.

A third modification employed in 36 cases follows the technique as described by Babcock and modified by Phillips of the Brookline Hospital. A continuous locking suture of No. 1 chromic catgut commencing at the left uterosacral ligament, incorporating peritoneum, fascia, and vaginal mucosa, is carried clockwise through a circle of 360 degrees, leaving a very small opening into the peritoneal cavity. This opening in turn is closed with 2 or 3 interrupted transverse sutures. This procedure reduces the operative time, lessens blood loss by an early control of cuff bleeding, and minimizes the vaginal denudation necessary for subsequent correction of the cystocele.

The Torpin modification of cul-de-sac excision, including excess vaginal mucosa and intervening fascia, closing the same with a continuous suture, has been employed 22 times. It was our impression that we encountered excessive granulation tissue in some of these cases at our postoperative examinations, but the efficacy of support of the posterior vaginal vault and obliteration of enterocele cannot be questioned.

Neglect of the cul-de-sac can be a cause of failure in an otherwise excellent operation. In our earlier operations we were unaware of the importance of demonstrating digitally the depth of the cul-de-sac immediately following extirpation of the uterus. In descensus uteri the posterior cul-de-sac is not opened at its lowest point. Failure to recognize the attenuated cul-de-

sac with or without enterocele and to correct it appropriately can result in an operative failure. Often the sacculated low cul-de-sac has been satisfactorily obliterated with 2 or 3 interrupted sutures of black silk commencing high on the uterosacral ligaments. We have had no recurrence of enterocele or vaginal vault prolapse where either this procedure or cul-de-sac excision or Torpin's modification have been employed.

Examination of the adnexa should also be performed immediately following extirpation of the uterus. Before this became a routine practice two patients were found to have developed subsequent pathology which might possibly have been prevented. In one an ovarian carcinoma was discovered two years following our surgery, resulting in her death one year later. The second patient presented herself with vague pelvic disability over two years following her vaginal hysterectomy and repair. A dermoid cyst was discovered and successfully removed abdominally. Since these experiences the adnexa have been routinely examined and in several instances unexpected tubal or ovarian pathology has been found and removed.

There is no generally accepted and uniform technique for the operation of vaginal hysterectomy. Our own operative procedure is a result of observation of the operation in many clinics in the hands of many operators.

In this group of 184 operations are included cases of very moderate relaxation and descensus as well as those of protruding cystocele and rectocele, deep enterocele, massive rectocele, and occasional prolapsus with accompanying inversion of the vaginal vault. In this latter group the hysterectomy is a minor procedure as compared to the subsequent vaginal restoration which may require dissection, support, and reconstruction from urethra to anus.

Likewise the uterine status has varied from atrophic postmenopausal avascular organs to uteri with massive fibroids requiring morcellation or uteri with formidable vascularity and fixation. While certain anatomical considerations and surgical principles are uniform and basic, it would indeed be naive to consider these extremes of pathology as necessitating the same operative procedure which for lack of a better term we would call vaginal hysterectomy and repair.

The technical adjuncts to surgery have been of inestimable value, chief among these being a skilled assistant. Heaney hysterectomy clamps and the Heaney retractors or modifications of the Deaver retractor as suggested by Counseller are helpful. Operative time has usually consumed between 60 and 90 minutes.

Complications

There were no deaths in this series of cases.

There were 5 incidents of delayed postoperative hemorrhage varying in occurrence from the tenth to the twenty-second day after the surgery was performed (Table VI). Four of these occurred over two weeks following the operation. Although several were severe, all were treated nonsurgically by transfusions, chemotherapy, and sedation.

TABLE VI. COMPLICATIONS (7.6 OF 184 CASES)

Immediate postoperative hemorrhage	0
Late postoperative hemorrhage	5
Broad-ligament hematoma and cellulitis	1
Pelvic cellulitis	4
Pelvic abscess	3
Pelvic peritonitis	1

One broad-ligament hematoma developed, complicated by a pelvic abscess. This case was the only one of prolonged morbidity (21 days) and in retrospect was poorly selected for the procedure employed.

There were 8 other cases of infection. These included one case of pelvic peritonitis and 7 cases of postoperative pelvic cellulitis, 3 of which developed abscess with spontaneous drainage.

The combined complications of hemorrhage or infection in 14 cases constituted 7.6 per cent of the 184 patients operated upon. There were 50 cases of morbidity (27 per cent) according to rigid standards of morbidity. Only 8 patients were morbid for over one week following surgery. With the exception of one case of broad-ligament hematoma previously mentioned there was no morbidity following the eleventh postoperative day.

Choice of the patient for the operation as well as fitting the operation to the need of the patient is vitally important in lowering the incidence of both complications and operative failures. I have mentioned our tendency to postpone plastic surgery upon the young. Equally important is careful evaluation of the pathology and symptoms in the psychosomatic, the maladjusted, the economically destitute, and the constitutionally inadequate. Ellison has recently again called our attention to the high incidence of failure when surgery is performed in these groups. However, these patients may require gynecological surgery and it has been our observation that, if so, the more radical operation of vaginal hysterectomy and repair, when indicated, will leave less postoperative disability than abdominal procedures of a more conservative nature.

The general preparation for surgery has naturally included thorough study and treatment of medical complications. Hypertensive cardiovascular disease and diabetes have been frequently noted, especially in the postmenopausal patients. Twenty-two, or 31 per cent of the 71 patients operated upon after the menopause, had medical problems of this nature.

Severe anemia has been treated preoperatively with preliminary transfusions, and a preliminary period of high-vitamin and estrogenic therapy, when indicated, has been employed prior to hospitalization.

The usual anesthesia has consisted of intravenous Pentothal-nitrous oxide-oxygen, augmented when necessary with cyclopropane and very occasionally with curare. The great majority of patients have been given a minimum of 500 c.c. of whole blood during the surgery. There have been no transfusion reactions and only a very few patients experienced anesthetic problems or shock during or immediately following the surgery. Rebreathing of carbon dioxide and oxygen is frequently employed during the first 12 hours. Prophylactic chemotherapy has not usually been employed.

Patients have been allowed up between the second and fifth postoperative days, depending upon their age, general condition, and sense of well-being. Indwelling catheters following extensive plastic operations are usually removed on the fifth day. Problems of urinary retention and occasional cystitis have been those of average experience.

Summary

One of the possible results of a broadening experience with this operation can be that of developing an overenthusiasm for the vaginal approach, for with increasing experience a certain proficiency and confidence are acquired. The fact that difficult cases can be done per vaginam should not blind the gynecologist's judgment, in that many pathological entities are still best

approached abdominally. Many problems may be encountered in vaginal hysterectomy including adnexal and uterine pathology, parametrial fixation, excessive vascularity, and difficulty of exposure. This form of practical experience should also lead the physician in an honest appraisal of his work to develop discrimination and selection in his choice of operative procedure.

Our results with a series of 184 private cases treated by vaginal hysterectomy, usually with extensive plastic surgery, have been good. Complications have been infrequent. Follow-up examinations upon these patients have generally revealed satisfactory vaginal reconstruction with disappearance of previous symptoms.

A diversity of technique has revealed no striking variation in end result, provided anatomical fascial reconstruction was accomplished. Complicating uterine or broad-ligament pathology or previous abdominal surgery need not be a barrier to vaginal hysterectomy. One may, however, occasionally encounter unexpected difficulty or hazard, whereupon the operation may at almost any stage be altered to a modification of the Manchester-Fothergill procedure. Based on our personal experience, which has been acquired by observation and practice, a wider use of the operation is urged to the members of this association.

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Discussion

DR. FRANKLIN L. PAYNE, Philadelphia, Pa. (by invitation).—My qualifications for this discussion are not those of an expert since our experience with vaginal hysterectomy has been limited, but as time passes it is increasing.

During the years 1942 and 1943, of 464 hysterectomies that were done in our clinic, 9 (2 per cent) were vaginal operations. During a similar span ten years later, of 1,237 hysterectomies, 101 (8 per cent) were done by the vaginal approach. Our indications for this operation consist of varying degrees of relaxation of the pelvic floor with in addition a need for hysterectomy during either the postmenopausal era or the menstrual age. In the latter group small myomas and dysfunctional uterine bleeding have served as the indications for the vaginal hysterectomy, while second- or third-degree descensus constituted the indication in the older group. For lesser degrees of descensus, in the absence of other indications for hysterectomy, we prefer the Manchester procedure.

While the contraindications to this operation vary widely with the experience of operators, they should be pointed out in this discussion. During a cursory review of the recent literature the following contraindications were gleaned from the writings of those who by virtue of abundant experience do qualify as experts. Beginning from below they are: high senile vaginal constriction, uterine malignancy, whether cervical or corporeal, myomas larger than a fetal head, unfavorably located myomas such as subvesical or intraligamentary, extensive adnexal disease or endometriosis, ovarian neoplasm, frequently previous pelvic abdominal surgery, and frequently a history of a previous low cesarean section.

We have adhered to these contraindications in the past and it appears that Dr. Bradford, with increasing experience, has not done so. In his report we find four instances of uterine malignancy, one of the corpus and three intraepithelial of the cervix. There were also seven ovarian cysts, the sizes of which were not recounted. Finally, Dr. Bradford points out that 20 per cent of the patients gave a history of previous pelvic surgery which is a commonly accepted contraindication to the vaginal approach. No doubt, his low incidence of postoperative complications is due to great surgical skill and fine pre- and postoperative care. It would be interesting to know whether the majority of these complications occurred following vaginal hysterectomy for those patients who had experienced previous pelvic surgery. Here Dr. Bradford's statement: "The fact that difficult cases can be done per vaginam should not blind the gynecologist's judgment," should be repeated.

It is commendable that all but 9 of the 184 patients were given the benefit of vaginal repair at the time of the hysterectomy. It is also commendable that the importance of recognition and repair of the cul-de-sac hernia was emphasized. This may need no re-emphasis to a group of specialists in the field of obstetrics and gynecology but the large number of cul-de-sac hernias and eversions of the vagina that we see following vaginal or abdominal hysterectomy call for repetition of two fundamental gynecologic concepts.

First, the logical surgical approach to relaxation of the pelvic floor is by way of the vagina. Second, simple removal of the uterus either abdominally or vaginally is not effective treatment for uterine prolapsus. Dr. Bradford's contribution should do much to re-emphasize the importance of these concepts and so reduce the incidence of repeated ineffective surgical attempts at the correction of pelvic floor relaxation.

DR. WAVERLY R. PAYNE, Newport News, Va.—In regard to the elderly patient, I long ago convinced myself that the physical fitness of the individual rather than the chronological age should be the prime factor when surgery is considered. Therefore, the patient's age and the history of previous surgery should not deter a competent pelvic surgeon from selecting the vaginal route for hysterectomy associated with necessary restorative procedures.

In my opinion, some of our older operations, such as the Manchester operation and Watkins interposition, are occasionally indicated instead of vaginal hysterectomy and repair. Anyone who conducts a routine follow-up on vaginal plastic and combined procedures for a matter of years will likely reach the same conclusions expressed by Dr. Bradford, namely, that individualization and modification of standard procedures must be employed in order to achieve the highest degree of success. It is only by adequate personal follow-up that one can improve his ability to evaluate properly the problems just discussed.

I would like to illustrate my change in attitude over a period of twenty-three years with a review of my operative records. In a series of 1,049 hysterectomies from my early years of private practice, 555 were total, 328 were subtotal, and 166 were vaginal.

During the last ten years the incidence of subtotal and vaginal hysterectomies has dropped to a yearly incidence of approximately 0.5 per cent. The Manchester operation and Watkins interposition operation are still occasionally done.

CONSERVATISM IN ENDOMETRIOSIS*

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THE management of patients with endometriosis must be highly individualized because of the multiplicity of problems in diagnosis and selection of therapy. This presentation will not attempt to include all details, but rather will be restricted to a few that are of particular interest.

In a broad sense, the management of patients with endometriosis is dependent upon the establishment of a correct diagnosis and an accurate interpretation of the potentialities of the various types of therapy. The latter is often made on the basis of clinical observations and upon analyses of the numerous statistical reports in the literature. It is to these that we shall direct most of our attention in this presentation.

The Problem of Diagnosis

It is obvious that the diagnosis of endometriosis must be made during the bimanual examination if the management is to be correctly applied. However, the diagnosis is made accurately in only 20 per cent of instances as reported in the over-all literature (Hofmeister and Grinney[1]). These figures do not represent the ultimate that can be attained. Hofmeister and Grinney reported an accuracy of 51 per cent in a group of patients personally studied, but when this group was subdivided it was found that one clinician made the diagnosis correctly in 75 per cent of patients examined by him personally. Gardner[2] states that a preoperative diagnosis can almost certainly be made if there are symptoms and/or characteristic findings.

The degree of accuracy of the diagnosis of endometriosis is adversely affected by those cases in which operations are performed for symptoms not corroborated by physical findings. Such patients often have no endometriosis. Physical findings indicative of the condition must be present before operation is advised.

One may fail to make the diagnosis because of several reasons. The most frequent reason is the failure of the examiner to palpate vaginally and rectally the posterior cul-de-sac and uterosacral ligaments in every patient. Other reasons are the inability to detect small peritoneal lesions and those more definite lesions that are obscured by coexisting pathologic processes such as fibroids, inflammatory disease, large ovarian tumors, and genital malignancies. Lesions located in the anterior cul-de-sac and small extra-

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peritoneal lesions in the bladder wall are frequently obscure. Acute pathologic processes in pelvic tissues also render a diagnosis difficult or impossible to make. Examples are: torsion of pedicles of pelvic tumors, ectopic pregnancies, ruptured cysts, diverticulitis, ileitis, and appendicitis. Granulomas and malignancies of the bowel occasionally create confusion. Under these circumstances diagnostic deficiencies are understandable.

When the posterior cul-de-sac is involved with endometriotic lesions, it is impossible, in many cases, to gauge the degree of involvement of the remainder of the pelvic tissues. In some instances the cul-de-sac may seem to be entirely obliterated and yet, when the pelvis is explored at operation, the lesions are small or may be completely extraperitoneal. On the other hand, on bimanual examination the cul-de-sac may seem to contain only a few small nodules and the other pelvic tissues appear free of lesions, yet the involvement is extensive.

Accuracy of diagnosis can be determined only by a study of patients operated upon. The degree of accuracy will be affected considerably if the pathologist's diagnosis of endometriosis is required to confirm the surgical and clinical interpretations. Histologic examination of the removed tissue does not always reveal endometriosis even though it is present. Such errors are frequently made in the cases of endometriosis of the uterosacral ligaments and posterior surface of the uterus. These lesions which are readily identified during the operation promptly lose their characteristic color and appearance after removal of the uterus. As a result, blocks of tissue are not taken from this region by the pathologist and the histologic diagnosis is not made. The gynecologist can be extremely helpful to the pathologist by designating in the fresh specimen the sites from which blocks should be taken. In this way the pathologist may have the opportunity to make the correct diagnosis in many more instances. The same procedure applies to all small endometriotic lesions that are removed.

Another frequent source of error occurs in the pathologic study of a blood-filled cyst of the ovary. Routinely, only a few microscopic sections are made from the wall of the cyst and the diagnosis is dependent upon a study of this infinitesimal portion of the tumor. More complete sectioning of the cyst wall may reveal endometriosis in some small region. The usual chance selection of blocks of tissue for microscopic examination is often inadequate, but, in a busy general laboratory of pathology, this is all that is possible.

The clinician may err in considering blood-filled ovarian cysts to be endometriosis and may take the pathologist to task when such a diagnosis is not forthcoming. Most hemorrhagic cysts, whether small or large, are not of endometriotic origin and, even though endometriosis is present elsewhere in the pelvis, such a cyst may well be of any type. We require microscopic proof of endometriosis in such cysts to establish the diagnosis.

In some instances, endometriotic lesions involving various genital tissues are not removed and thus the histologic diagnosis cannot be made.

The requirement that the diagnosis of external endometriosis cannot be made unless it is substantiated by histologic examination is not entirely reason-

able in all cases. We are hesitant to use clinical judgment in diagnosing an ovarian blood-filled cyst, but there is no hesitation in identifying those typical lesions of the peritoneum and uterosacral ligaments.

In those cases in which the surgical diagnosis is unquestionably endometriosis and the pathologist does not make the diagnosis, the hospital records should be signed out according to the pathologist's diagnosis, but the addition of "endometriosis (surgical diagnosis)" should be made. In this way all records of patients with endometriosis, or with that which is thought to be endometriosis, are classified, coded, and available for study.

Endometriosis and Fertility

Since the relation of infertility to endometriosis is such an important problem, and since endometriosis is essentially a surgical disease that often requires rather extensive procedures which may interfere with the childbearing function, it is desirable to discuss this point.

The exact fertility rate of patients with endometriosis is impossible to determine. The number of women in the general population with endometriosis is not known. Many, who have endometriosis, do not seek medical care. It is also reasonable to assume that many patients who have endometriosis and who are under medical care do not have this diagnosis made. This must be true since most women are not subjected to vaginal examinations. Even if they were done, the acknowledged inadequacies and errors in making the diagnosis will almost hopelessly distort the statistics. This latter fact has induced almost everyone to utilize in his statistics only those patients who have come to operation. A few, however, use data obtained from patients not operated upon. By whichever method or by a compilation of data from both, fertility rates have been calculated and quoted.

Examples of a few of the fertility rates given in the literature are quoted: Keene and Kimbrough,[3] 59.1 per cent; Kelly and Schlademan,[4] 46.4 per cent; Te Linde and Scott,[5] 66.5 per cent; Hofmeister and Grinney,[1] 62.4 per cent; Siegler and Bisaccio,[6] 66 per cent; Meigs,[7] approximately 66 per cent; and Haas[8] reported a fertility rate of 8.6 per cent in 35 patients.

It has become a common procedure to compare these data with the overall fertility rate in the general population which is given as 88 per cent by Reynolds and Macomber.[9] From this, and from clinical impression, it has been concluded that there is reduced fertility in patients with endometriosis. It may well be that this is true, but such a conclusion cannot be drawn from the data available. The two samples are not equal or comparable. The only things in common between the two are that the individuals are women in the childbearing age and are married.

The sample composed of women with endometriosis is highly selected from the very beginning in that the women are patients in a physician's office. They are entirely unlike the general population. The sample is further selected through the process of diagnosis. The error in diagnosis ranges from 25 to 86 per cent, with an average of 80 per cent. Such an error makes

it necessary that the diagnosis be proved at operation, but this again highly selects the sample because the patients to be included must be operated upon. Since all patients with endometriosis are not operated upon, it means that a selection is made as to those who need operation, still further reducing and selecting the sample. Owing to the marked variation in the thinking of the medical profession with respect to the indications for operation in patients with endometriosis, there is no uniformity or equality of selection of the sample.

Those patients with severe symptoms, and/or extensive lesions, are more likely to be selected for operation and, thus, are predominant in the sample—an undue weighting and selectivity. On the other hand, a considerable number of patients with minor lesions that are discovered during an operative procedure for some other lesion or disease are included—a selection of women to be incorporated into the sample. The sample is again selected at operation—those in whom no endometriosis is found are discarded; those in whom a diagnosis of endometriosis is not forthcoming from the pathologist are dropped by some gynecologists and included by others who rely upon clinical judgment. There is an error of 8 per cent between the surgical and the pathologic diagnoses.[7] Those patients in whom there is some other cause for sterility are discarded even though they have endometriosis. Such a sample is too highly selected and is not representative.

Variability in the sample results also from the inclusion of patients with primary sterility only by some authors, while others include patients who have had children but who have not been pregnant for a period of time. An important variable is thus introduced—a time factor. In the sample made up of patients with proved endometriosis, a patient is considered nonfertile if more than two years have elapsed since she was pregnant, or since she had attempted to conceive. In the general population, no such restricted time limit is considered. In the latter, a pregnancy at any time during the life of the woman qualifies her as fertile. Any one of these methods of selecting women to represent the final sample makes the sample so different from the general population that a true comparison cannot be made. Despite this high degree of selectivity, the fertility rate of the sample of patients with proved endometriosis is approximately 60 per cent. That of the general population is 88 per cent.

Turning to the accumulation of statistics regarding the enhancement of the fertility rate following conservative surgical procedures for endometriosis, further weighting and selection of the sample are noted in addition to all that has gone before. Discarded from the sample are those patients in whom the childbearing function is destroyed by the surgical procedure.

Selecting only those patients who have conservative operations again is a biased procedure, since minor lesions predominate. Methods of selecting the sample are as variable as the opinions of the gynecologists performing the surgical procedure. A large proportion of women under 35 years of age have conservative operations, again varying the sample from the general population on the basis of age. After operation, if a patient does not desire pregnancy

and/or if she uses contraceptive measures, she is dropped from the sample, while in the general population no such selection is made. Thus, the two samples differ again.

Statistics accumulated in this manner do not permit one to conclude that the operation was the factor that altered the fertility rate either favorably or unfavorably. Other factors undoubtedly are at play. It allows one only to state that after operation a given number of patients become pregnant. This may be all that the various authors intended, but other workers have used the figures as given to make comparisons which are not tenable. The final sample after operation is then composed of married individuals predominantly under 35 years of age, who desire and constantly and persistently attempt to become pregnant, who have selectively had conservative operations for endometriosis, who have all the necessary requirements for pregnancy, have no other cause for the sterility, and who have not had a child for 2 or more years prior to operation.

It is impossible to make comparisons between the fertility rate of this extremely highly selected sample of postoperative patients with that of patients prior to operation and that of women in the general population. This is true, despite the possible or even probable fact that formulas for determining significance would indicate that the figures are significant. Such formulas are dependent upon the basic premise that the samples are comparable, but in this case, they are not.

The method of compiling the statistics is subject to error. Most are compiled by reviewing hospital records for several years in the past. Almost none of these records contain adequate information to permit the researcher to diagnose in retrospect that a given patient was sterile unless that was her complaint upon admission to the hospital. The fact that she had never been pregnant, or that many years had elapsed since she was pregnant, might well be owing to the fact that she had used contraceptives or had otherwise avoided pregnancy. Hospital records do not include such information. The only way to make the study is to do it on a current basis.

These remarks are not to be construed as an expression of nonbelief concerning the long-established clinical observation that sterility and endometriosis have some cause-and-effect relationship. Rather, they are a criticism of the statistical methods used in the attempt to prove or establish that such a relationship exists.

These reports should be taken for what they are, namely, clinical observations. As Mainland[10] has stated, "It is on such observations that properly planned experiments can be constructed." When such experiments for the study of endometriosis have been set up and completed, our ideas of this condition will be more firmly established. The difficulties in making such studies are great, but not impossible. Until they have been completed we should not disregard experience since clinical research can be as sound as laboratory experiments, provided that certain principles are followed (Mainland[10]). On the basis of clinical observations and experience, pregnancy does occur after conservative operations for endometriosis and this should induce the operator to be as conservative as is consistent with good judgment in his selection of the operative procedure.

Conservative Management

Conservative management consists of: (1) no treatment; (2) medical management; (3) temporary castration with radiation; (4) operative procedures with retention of childbearing function. Some gynecologists consider an operative procedure conservative if the uterus is removed but the ovaries are retained. This procedure performed on a young woman would be radical.

Fig. 1.—Photograph taken at operation showing a hemorrhagic endometrial cyst of the right ovary and a portion of the uterus (*A*).

The best way to assure that treatment is conservative is to use no therapy at all and/or to use very simple medical management. An operative procedure that is intended as a conservative one frequently may terminate as a radical one, because the pelvic organs may be more extensively involved than anticipated. Or the gynecologist may do an incomplete conservative operation while realizing that it is undoubtedly inadequate. Since patients with all types and degrees of severity of endometriosis can and do become pregnant, and since it is acknowledged that all patients with endometriosis do not require treatment, there is no great urgency to advise operation. Unless there is some dramatic occurrence, such as intraperitoneal bleeding, or unless the symptoms are severe, time is often helpful and some procrastination is justified.

Medical management consists of hormones and pain-relieving drugs. Dysmenorrhea may be alleviated by daily doses of estrogenic hormone administered orally for the six days immediately preceding ovulation. More persistent and severe pelvic pain may be controlled by daily doses of 10 to 100 mg. of diethylstilbestrol. Such therapy should not be continued for more than two or three months. Androgens in doses not exceeding 200 mg. a month have been used with good results by some clinicians, but estrogen therapy is just as effec-

tive and is less prone to produce aggravating side effects. Combinations of estrogens and androgens provide no better end results. Abnormal uterine bleeding can also be relieved with the use of large daily doses of estrogen in many patients. With such therapy as this it is possible to forestall operation for a considerable length of time, and in young women this is often highly desirable.

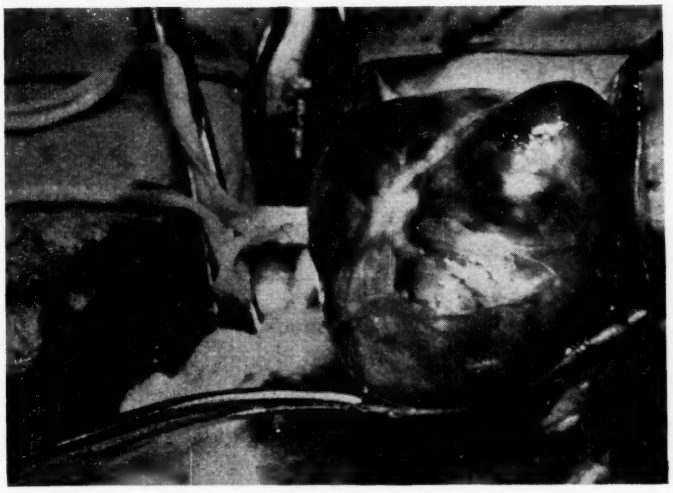

Fig. 2.—The endometriotic cyst is partially enucleated. The thinned-out normal cortex of the ovary is held in the clamps.

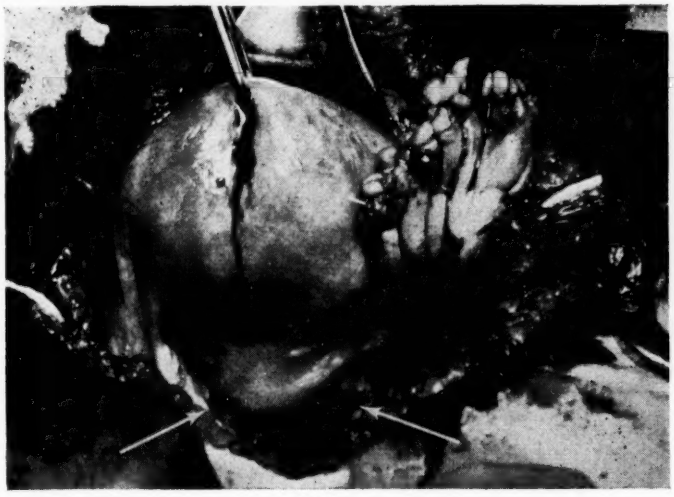

Fig. 3.—The ovary has been reconstructed. It is of normal size and contains the normal functioning elements. The endometriotic lesions (arrows) involving the uterosacral ligaments were resected after this photograph was taken.

During this time, and even if no therapy is utilized, many patients will become pregnant. Some clinicians advise operation as soon as the diagnosis is made, but we are not in accord with this practice. We prefer to await the patient's effort to become pregnant, to give considerable time to the study of her symptoms, and to utilize some medical therapy to relieve the symptoms if they are mild or only moderately severe.

Radiation therapy for the production of temporary castration has not been used by us so we personally know very little about it. Whenever its use has been considered, in a particular situation, we have reverted to a surgical procedure. The latter permits a wider range and a greater selectivity of action without the risk of producing permanent castration.

Conservative surgical procedures have as their objective the relief of symptoms and/or the removal of potential hazards without interfering with future childbearing. This is not easy of accomplishment. It is here that individualization of therapy is so urgently required. Each factor must be considered and weighted in light of past clinical observations and experience. If it is not possible to retain childbearing function, an effort is next made to conserve some ovarian tissue, even though the uterus is removed, provided that the status of the patient warrants such a procedure.

In women under 35 years of age an extreme effort is made to preserve childbearing function. In women between the ages of 35 and 45 some ovarian tissue is saved if possible. After 45 years of age, radical procedures predominate. These are generalities and do not take into account the many factors that must be and are considered. Radical procedures are done occasionally in women in the earlier age group and conservative procedures have been done in women after 45 years of age, but the general principles are as stated.

Conservative operations are particularly suitable in patients with small, multiple peritoneal implants. These lesions are often incidental findings at operation as they can seldom be palpated during bimanual examination. They tend to remain local, superficial, small, and noninvasive during their entire existence and are seldom associated with adhesions. In many ways lesions of this type behave differently from other endometriotic lesions. There is no hesitation in leaving them in place in some instances since they do not appear to progress to any great extent. This is particularly true if the uterus is removed. Ware[11] and others have reported similar observations. Their presence is not an indication for radical operations.

Ovarian endometrial cysts usually have been considered an indication for removal of the gonad. This is not, however, always an adequate reason to remove the ovary if it is desirable to conserve ovarian function. In many cases the cyst can be enucleated with ease and the entire capsule of the ovary, with all the functional elements, can be retained intact. Figs. 1 and 2 demonstrate the method of removal of the cyst. Fig. 3 shows the reconstructed ovary. The contention of some writers that such a procedure should not be done because adhesions result, which cause trouble and necessitate additional operation, is not tenable. We have carried out operations of this type for many years and have seen no complications or bad results. Quite to the contrary, we advise that it be done whenever it is desirable to save ovarian function.

The decision that a procedure which conserves childbearing function will be suitable is usually not made until the pelvic organs are inspected at operation. It is then based upon the operator's opinion that the symptoms can be relieved with sufficient certainty to justify the procedure. In some instances, it is based on the operator's belief that the procedure will enhance subsequent fertility.

That the symptoms are not always relieved is attested to by the fact that reoperation or radiation therapy is required subsequently in some instances. For example, Schmitz and Towne[12] did conservative operations in 82.5 per cent of cases and had a reoperation rate of 46.6 per cent; Te Linde and Scott,[13] 74.4 per cent conservative operations and 12.2 per cent reoperations; Meigs,[7] approximately 75 per cent conservative operations with a reoperation rate of 6.9 per cent; and Fallas,[14] 56 per cent conservative operations with a 2 per cent reoperation rate.

This need for further and more radical therapy does not mean that a radical procedure should have been done at the first operation. During the interim between operations many of these patients will deliver normal children and this completely justifies conservatism at the first operation. If the operation is performed because of the severity of symptoms, and if it is conservative because of the hope of the operator that pregnancy will ensue, then we are in accord with its necessity. However, if the operation is performed in an attempt to enhance fertility alone in the absence of symptoms, then we doubt the desirability of the procedure. We agree with the statement made by Counseller and Crenshaw[15] that young patients, if treated medically or not at all, will have about as many children and will be about as comfortable as those operated upon conservatively, until they reach an age when a more radical and adequate procedure can be performed, if it becomes necessary. If this line of thinking is followed there will be fewer operations performed upon young women; there will be fewer conservative operations as a consequence; symptoms will be relieved with more certainty, and fewer patients will require a second operation. Accordingly, Counseller and Crenshaw[15] report only 11.6 per cent conservative operations. This type of management is justified if it is relatively certain that resection of endometriotic lesions in the early stages of the disease will not increase the fertility rate. This controversial point must remain unsolved for the present because of the lack of valid statistics. Some of the fertility rates subsequent to operation, as reported in the literature, are given here without being subjected to a critical analysis: Vejaskari,[16] 81 per cent; Norwood,[17] 74 per cent; McGoogan,[18] 53 per cent; Hofmeister and Grinney,[1] 50 per cent; Huffman,[19] 47 per cent; Te Linde and Scott,[13] 40.6 per cent; Haas,[8] 40 per cent; Fallon, Brosnan, Meyers, and Manning,[20] 37 per cent; Meigs,[7] 32 per cent; Kelly and Schlademan,[4] 29 per cent; Keene and Kimbrough,[3] 28 per cent; Siegler and Bisaccio,[6] 28 per cent; Counseller and Crenshaw,[15] 27 per cent; and Bacon,[21] 26 per cent. Lock and Myers[22] summarized the reports in the literature and found the average fertility rate after operation to be 32 per cent. These observations indicate only that conservative operations for endometriosis are followed by pregnancies. They do not prove that there is a causal relationship between the operation and the subsequent fertility.

In the report by Siegler and Bisaccio,[6] nearly as many patients became pregnant who were treated medically or not treated at all, as did those who were operated upon. This is particularly true if the two patients in their study who

had only presacral neurectomies are deleted. Creadick[23] reported a 25 per cent fertility rate in patients treated by androgenic therapy, and in a recent personal communication stated that with the passing of more time this same group of patients now has a fertility rate of 60 per cent.

Despite the inadequacy of the statistical methods and the uncertainty concerning the question of whether an operative procedure in itself enhances fertility, there is one point that these clinical observations have firmly established—when operations are performed for endometriosis or when endometriosis is encountered during any abdominal operation, approximately one-third of the patients will subsequently conceive if conservative procedures are performed and if there are no other causes for sterility. For this reason conservatism is advocated when operations are indicated in patients who are desirous of having children and when retention of such function is compatible with the individual situation.

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CONTINUED STUDIES ON THE TREATMENT OF TRICHOMONAS VAGINALIS INFECTIONS*†

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INVESTIGATORS have long searched for an effective treatment for Trichomonas infections of the human vagina, but with little success. During the two years since our last discussion of the subject, several new treatments have been reported in the literature, but without any evidence of better results than with many of the older types.

One year ago we undertook a new study of the varied problems of treatment. Investigations related to possible sources of infection other than by contact with a carrier gave no new evidence. Our effort shifted in the hope that something might be done to improve treatment of this infection.

In our preliminary report two years ago we[1] stated " . . . that the *T. vaginalis* is capable of burrowing deeply into the roughened surface of the vaginal and probably the cervical mucosa, where the albumin normally present acts to protect many of the organisms from surface medication." Our studies of the antiseptics commonly used in the treatment of *T. vaginalis* infections showed that most of them coagulate albuminous material and, as a result of this albuminous coagulum, damage to the flagellates not on the surface is prevented. As a result of our observations both in vitro and in vivo, it was agreed that a satisfactory trichomonacide should have the ability to penetrate and dissolve mucinous material, not irritate the already inflamed mucosa, and at the same time be lethal to the flagellates within three minutes. We tested as many as possible of both old and new products, but none had these qualities.

Prolonged studies of the *T. vaginalis,* using phase-contrast microscopy, suggested the possibility of attacking them with some of the surface-acting chemicals. One of us (C. G. G.), with years of experience as a cell physiologist, undertook the preliminary work. Later, using a technique described by one of us (C. H. D.[2]), a large number of chemicals possessing either detergent, chelating, or wetting properties was tested, with the use of the phase-contrast microscope. After many experiments with easily obtained materials we developed a mixture containing detergent, chelating, and wetting agents, which proved in vitro to be very effective, killing the flagellates under thirty seconds in a dilution of 1:250, and under a minute in a dilution of 1:500.

A considerable variety of chemicals having detergent, chelating, or wetting properties then were obtained from chemical manufacturers for investigation. Using a 1:500 dilution of each chemical, all were eliminated which did not kill

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our flagellates within three minutes. This narrowed the number to six, namely: (1) lauryl sulfate sodium salt; (2) lauryl sulfate triethanolamine; (3) alkyl aryl sulfonate amine; (4) alkyl aryl sulfonate triethanolamine; (5) polyoxyethylene tridecanol; (6) polyoxyethylene nonyl phenol. After a number of tests, polyoxyethylene nonyl phenol proved most satisfactory and was selected as the detergent of choice for further study.

Based on earlier observations we next tried various combinations of detergent, chelating, and wetting agent. Again it was noted that the addition of a chelating agent to the detergent made it possible to kill the flagellates quickly in a greater dilution. Addition of the wetting agent further increased the effectiveness of the mixture. Early in this phase of our experiments some separation of the mixture indicated lack of a balanced blend. After many tests and changes in proportion of chemicals, we developed a balanced blend which contains the following chemicals: as detergent, polyoxyethylene nonyl phenol; as chelating agent, sodium ethylene diamine tetra-acetate; as wetting agent, sodium dioctyl sulfosuccinate. In the dilution used clinically it destroys the flagellates within seconds; it dissolves mucinous materials, fats, and blood clot, yet apparently is nonirritating to mucous membrane and skin.

Tests show that some flagellates will survive more than fifteen minutes when any one of the three chemicals is used alone in the dilution employed clinically. But if we combine the detergent and chelating agent, all organisms are killed in an average of one minute and fifteen seconds. When the wetting agent is added as in our formula, all trichomonads are killed in less than thirty seconds and disintegration starts in less than one minute. The cumulative or synergistic action of detergent, chelating, and wetting agent has produced a germicide lethal for various animal parasitic organisms, in a dilution that is relatively nontoxic. Preliminary experiments with bacteria suggest that in greater concentrations there may be either a bacteriostatic or bactericidal effect.

In vivo tests indicate that we have developed an easily used germicide capable of destroying within a very short time all trichomonads *in* the vaginal canal. The treatment in the office consists of drying and thoroughly washing the vaginal canal with a 1:250 dilution. This should require about three minutes. The vagina is then dried with cotton balls and the patient leaves, with no mess, no stain, no tampon. Home treatment consists of douching (a teaspoonful to a quart of warm water) once or twice daily the days she does not come to the office. While we recommend three office treatments the first week, two the second, and one the third, several of our patients have had not more than a total of three office treatments, yet have had no flagellates when they come for a check a month after diagnosis was made. Two apparent failures resulted from attempts to douche while standing in a shower stall. Only office treatment is advised for pregnant women.

Carlen-K_1 or Carlendacide, as the new surface-acting germicide will be called, is alkaline, the pH in the dilution used clinically being about the same as that of cervical mucus. Since we now recognize that the pH of body secretions remain very stable, it is no longer believed necessary to use an acid douche

in treatment of *T. vaginalis* infections. Our checks of a vinegar douche solution with a pH of 3 failed to show any evidence of damage to the flagellates in fifteen minutes.

Carlendacide inactivates sperm cells within one minute in the dilution employed, and if a pregnancy is desired the douche should not be used within the first few hours after coitus. Otherwise, we advise an early douche, as there is always the possibility that a prostatic infection may exist. Since we usually do not know the source of the infection, it is suggested that the douche be used twice per week indefinitely. No evidence of harm has followed daily douching during menstrual periods.

Carlendacide, acting as it does through marked changes in surface tension, should not be compared with antibiotics. Studies with phase-contrast microscopy show that many of the flagellates explode when brought in contact with this solution, and only small fragments remain. If a cure is not obtained with one course of treatment with Carlendacide, we believe that a focus of infection will be found in urethral, vestibular, vaginal, or cervical glands. A very few cases of *T. vaginalis* salpingitis have been reported. In the case of cows, *T. foetus* commonly involves the uterus and is a cause of abortion.

A variety of toxicity tests has been performed. Used in tissue cultures a 1:400 dilution does not prevent growth or show evidence of damage to growing cells. Two groups of laboratory mice have had concentrations of 1:500 and 1:250 in their drinking water since Aug. 29, 1953. Young born during the experiment have matured and continue to drink water containing Carlendacide. Three groups of young chickens have had a concentration of 1:1,000 in all of their drinking water. The mortality among these has been less than with controls using tap water. Full strength has been applied repeatedly to the skin of individuals sensitive to many chemicals, without evidence of irritation. Yet we realize that an occasional woman may prove allergic to this germicide and be unable to use it.

Our discovery that there is a synergistic action between a detergent, a chelating, and a wetting agent cannot be evaluated today. It opens new possibilities for medical research in control and treatment of a variety of diseases that affect both man and lower animals.

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1. Davis, Carl Henry, and Grand, C. G.: AM. J. OBST. & GYNEC. **64**: 544, 1952.
2. Davis, Carl Henry: J. A. M. A. **92**: 306, 1929.

BOX 43, COCONUT GROVE, FLORIDA

Discussion

DR. WILLIAM M. BRYAN, JR., Columbia, S. C.—We have just completed a month's study of 257 unselected cases from the Obstetrical and Gynecological Clinic of the U. S. Naval Hospital, Charleston, South Carolina, wherein *Trichomonas vaginalis* was sought for microscopically using the wet saline method.

The age range of the patient was 16 to 66 years, with the great majority in the childbearing age. Of the 257 patients 244 were white and 13 Negro.

In the 257 unselected cases there were 17 positive smears, an incidence of 6.6 per cent and of these 17 positive smears 8 patients were symptomatic and 9 presented no symptoms whatsoever.

This small series is not exactly typical of the figures usually given for Trichomonas infestation. First of all, the incidence of positive smears in our series was only 6.6 per cent.

Most investigators claim to examine a slide for about five minutes. We averaged about three minutes to a slide. Possibly a more diligent search would have yielded a higher percentage of positive slides. It certainly should have been higher if one believes the truth of the statement that some 10,000,000 women in the United States harbor the flagellate.

The culture method often demonstrates the presence of Trichomonas after failure to find them by the wet saline method.

We were surprised at the paucity of symptoms since only half of the positive group complained of any trouble at all. No patient complained of severe itching, intertrigo, dyspareunia, and dysuria as is often the case in the classical textbook picture. Such symptoms do occur, of course, and it is the uncomfortable patient who first seeks our help.

We all know full well the vagaries of trichomoniasis. We see the asymptomatic patient who is loaded with motile flagellates and we see the very uncomfortable patient in whom the protozoan is most difficult to locate.

It is quite easy to cure most cases of trichomoniasis if one takes the time and effort to impress upon the patient the necessity of diligence of treatment. It may be well also to explain the fact that some 10 to 20 per cent of cases are quite resistant to treatment.

In the resistant or recurrent case one must eradicate foci of infection by electrofulguration or cauterization of Skene's ducts, cervical erosions, lacerations, ectropions, and polyps. One must investigate the sources of reinfection such as the bladder, Bartholin's glands, and the rectum and re-establish correct hygienic practice, never forgetting, of course, an investigation of the male.

In the literature one may find seemingly convincing evidence of the value of literally hundreds of trichomonacides. Each of us probably has his own particular method of treatment that he finds quite successful in his own hands. It is the occasional recurrent or reinfected case that taxes our therapeutic ingenuity.

The investigations done by Drs. Carl Henry Davis and C. G. Grand would seem to be the answer to the long-sought-for ideal trichomonacide. Their results in the research and clinical investigation of Carlendacide leave little to be desired. Inviting as the success of this drug may seem, we should not fail to continue persistent treatment of the patient, sources of reinfection, and the male partner.

DR. NORMAN McLEOD, Miami, Fla.—I have treated sixteen patients who had a *Trichomonas vaginalis* infection with Carlendacide. The smears became negative within two weeks in all but two cases.

Further instruction was given to these two patients, and their smears were negative 10 days later.

There were no reactions to the solution. Patients with severe vaginitis tolerated Carlendacide with no discomfort.

ANOTHER METHOD OF TREATMENT OF VAGINAL DISCHARGE USING CENASERT TABLETS*

GEORGE C. ROGERS, M.D., AND JOHN M. FLEMING, M.D., SPARTANBURG, S. C.

A VAGINAL discharge is one of the most annoying medical conditions that women are confronted with. The most common causes of vaginal discharges are Trichomonas, Monilia, and mixed infections. It is infections of these types treated by "Cenasert" tablets that constitute the subject of this report.

Many methods of treatment and many medications have been used, but none have been found to be ideal. The reasons for failure are numerous. The cervix, Nabothian glands, and Skene's glands are all places where the organisms may lurk. The rugae of the vagina can also hide or protect the organism from treatment. The husband may be a source of reinfection.

In our series the diagnosis was first made in the usual manner by hanging-drop preparations and smears. A therapeutic procedure then was adopted and carried out as follows:

The vagina was scrubbed with cotton and Septisol containing hexachlorophene and then rinsed with plain water and dried with cotton. Any raw areas on the cervix were cauterized with a high-frequency apparatus or silver nitrate. The vagina was then packed with aqueous Metaphen, 1:2,500 solution, and plain gauze. This pack was left in until the following night when it was removed at home.

The patient was instructed to take a douche each evening using ¼ teaspoonful of iodine (U.S.P.) to 1 quart of hot water and following this to insert a Cenasert tablet into the vagina. Another Cenasert tablet is inserted in the morning without a douche and this is continued for six to seven days.

After about a week the patient returned for a checkup without having a treatment for about twenty-four to thirty-six hours. At this time another smear was made to see if any organisms were present and, if so, the same treatment was repeated. Generally, after the first seven days the infection was found to be under control so the patient needed to take a douche and insert a tablet only at night. During the menstrual period douches at night and the use of the tablets night and morning were continued and the patient was expected to return as soon as the flow was over for an office checkup. As the infection regressed the treatments were spaced further apart. To prevent recurrences it was found advisable to have the patient take a douche and use the tablet once or twice a week through one to two periods and during the flow of two to three periods.

The formula for the Cenasert tablet† was as follows:

9-Aminoacridine hydrochloride	2.0 mg.
Phenylmercuric acetate	3.0 mg.
Methylbenzethonium chloride (Di-isobutyl-cresoxy-ethoxyethyl-dimethyl-benzyl ammonium chloride) quaternary ammonium salt	1.8 mg.
Succinic Acid	12.5 mg.
Chlorophyll	2.0 mg.
Lactose q.s. to	900.0 mg.

Buffered to pH 4.0.

*Presented, by invitation, at the Sixteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Hollywood Beach, Florida, Jan. 14, 15, and 16, 1954.

†Manufactured by the Central Pharmacal Company, Seymour, Indiana.

The rationale for the various ingredients in the tablet was as follows:

9-Aminoacridine hydrochloride was used because of its specific action against Monilia and also as a bactericidal agent, although it has no effect against Trichomonas.

Phenylmercuric acetate was specific against Trichomonas, but has no effect on Monilia.

Quaternary ammonium salt was used as a "wetting agent," causing the other ingredients to spread over the entire mucosa. It is also a bactericidal and bacteriostatic agent.

Succinic acid was used as a buffer to maintain a pH of about 4.

Chlorophyll was used as a deodorizing agent.

Lactose was used to help maintain the normal flora of the vagina and to encourage the growth of the Döderlein bacilli.

Results of Treatment

There were 37 cases in this series of which 14 were due to Trichomonas, 20 due to mixed infection, and 3 due to Monilia. This is a small number of cases as compared to reports from charity clinics and outpatient departments. All these cases occurred in private practice and we feel that the results are more accurate than those from outpatients or charity clinics, since patients in private practice are more able to follow instructions and are interested in getting well as soon as possible.

In 14 cases of Trichomonas infection the results were as follows:

4 cases cured in one week	28.5%
5 cases cured in two weeks	35.7%
3 cases cured in four weeks	21.5%
1 case cured in six weeks	7.14%
1 case cured in twelve weeks	7.14%

In 20 cases of mixed infection:

6 cases cured in two weeks	30%
5 cases cured in three weeks	25%
2 cases cured in six weeks	10%
4 cases cured in eight weeks	20%
3 cases were complicated with improvement but no cure	15%

In 3 cases of yeast infection:

1 case cured in three weeks	33⅓%
1 case cured in four weeks	33⅓%
1 case cured in six weeks	33⅓%

The partial failure in 3 cases of mixed infection were due to special complicating features in each instance. One patient was a pregnant woman who did not follow the routine of treatment, but was improved. The second patient had a history of treatment off and on for two years, with involvement of Skene's glands. The third was a nulliparous woman who gave a history of discharge and treatment for 4 to 5 years. She had had a supracervical hysterectomy and both the cervical stump and Skene's glands were infected. The second and third of these patients improved and remained symptom free as long as the prescription was used.

Reaction.—Only one patient reported any burning or itching and no sensitivity reaction could be found on examination. In the extremely raw and eroded areas, the Septisol does not cause nearly as much burning as does ordinary green soap. Aqueous Metaphen, 1:2,500, causes no reaction at all.

Advantages.—Aside from the specific effect of the ingredients, one advantage was that the tablet on melting covered the entire vaginal mucosa including the folds in and between the rugae, and it did not as a rule run out. Only occasionally was a pad necessary. Also, the tablets were easy to insert, were not messy, did not stain clothes, and there was no applicator to wash afterward.

Conclusions

1. Cenasert tablets were most effective in Trichomonas infection, 28.5 per cent being cured in one week and 35.7 per cent in two weeks.

2. They were also effective in mixed infections, 30 per cent of cases being cured in two weeks.

3. In Monilia, they were the least effective. Other medicines appear to be more specific in the Monilia infections.

4. The tablets were easy to insert, the solution did not run out excessively, did not stain clothes, and coated the vagina and rugae completely.

5. They caused irritation in only 1 case of the 37 treated.

1 Catawba Street

Discussion

DR. EDWARD F. HARDMAN, Charlotte, N. C.—Although the group of organisms responsible for the conditions discussed in this paper by Drs. Rogers and Fleming are not in themselves responsible for serious diseases that threaten life, they have been responsible for untold amounts of discomfort and inconvenience to the unfortunate women so afflicted.

The large number of drugs and methods used in the treatment of these conditions attest the fact that we have no group of drugs or method which seems to give uniformly good and quick results in a majority of these cases. With this in mind, I believe that Drs. Rogers and Fleming have attacked this problem in their own practice in a very rational manner.

Due to the fact that these conditions are not basically serious, I believe we as gynecologists have been too prone to treat them lightly and have placed the burden of treatment squarely on the shoulders of the patient alone. Drs. Rogers and Fleming, in their approach, have definitely *shared* the responsibility of treatment by a rigid follow-up schedule and *active* participation in the treatment.

Certainly, the composition of the medication used is not new. Many preparations use phenylmercuric acetate as an agent against the trichomonads, and combine a wetting agent, bacteriostatic agent, and a buffer. Silver picrate, arsenicals, Tetronyl, Aureomycin, and other antibiotics and chemotherapeutic agents have been used with enthusiasm by some and with disappointing results by others.

The elimination of the causative organism, the restoration of the normal bacterial flora of the vagina, and the elimination of the sites of reinfection seem to me to be the basic objects of treatment in these cases. The continuation of the treatment throughout the menstrual period is most important. It is during this time that small foci of the causative organisms, which may have escaped elimination, are prone to multiply.

In this paper it is noted that 28 per cent were "cured" in one week. One also notes that the treatment was continued through two or three more periods. I believe, had the treatment been discontinued after one week, a large number of these cases would again have become smear positive.

In spite of the messy aspects of the treatment, I have found that the gentian violet preparations seem to get the best results in the mycotic vaginal infestations, and although I often try other preparations in the mycotic group, it is frequently necessary to resort to gentian violet in the more resistant cases. During pregnancy, however, the mycotic infections seem to be most resistant, and it is in the pregnant patient, in the diabetic patient, and in the postmenopausal woman where many, if not most, of this latter group are found. Improving the vaginal mucosa by proper treatment of the systemic disease in diabetes, and by hormone treatment of the postmenopausal woman greatly facilitates the treatment of the mycotic infestation.

The nonspecific vaginitis group, made up principally of the streptococcus, staphylococcus, and colon groups, respond more readily and are frequently cured in a matter of a few days by antibacterial agents and the re-establishment of a normal vaginal pH.

It has always seemed to me that attention to the fine details of treatment in the care of these patients is more important than the specific agent used. Specific instructions on douching are of great importance, and certainly proper hygiene after bowel elimination will eliminate one source of reinfection.

The essayists have done an excellent job in their attention to the possible sources of reinfection, together with more careful follow-up, and are to be commended for it. I believe it has been from this latter standpoint that they have been successful. In the end, one will save the patient both time and expense and will also save time for the doctor with this detailed attention. If one is willing to take the time for detailed instructions to the patient, no matter how simple they may seem, then one can expect better cooperation from the patient and a low incidence of treatment failure.

DR. C. L. RILEY, Winchester, Va.—Drs. Rogers and Fleming have provided us with a useful agent for the treatment of certain types of vaginitis. That no completely satisfactory remedy has been found is evidenced by the more than 200 remedies proposed.

Action of trichomonacidal compounds is dependent upon a direct or osmotic effect and to be acceptable they must be harmless to the host, acceptable to the patient, and readily adaptable for home use.

The results obtained by Drs. Rogers and Fleming using Cenasert tablets indicate fulfillment of these criteria, satisfactory trichomonacidal effect, control of mixed infections, and to a lesser extent some antimonilial action. In that an active ingredient of Cenasert is a mercury derivative, a history of mercury sensitivity deserves special consideration. Most other trichomonacidal drugs contain mercury, arsenic, or iodides, and the same caution is exerted. The growth and culturing of *Trichomonas vaginalis* by Trussell, Plass, Johnson, and others, satisfaction of Koch's postulate, and establishment of *T. vaginalis* and *T. intestinalis* as separate and distinct organisms have served to crystallize our thinking as well as solve many previous controversial issues.

Terramycin tablets used locally have given us satisfactory results for the treatment of vaginitis due to mixed infections and that due to the Trichomonas, with certain reservations. *B. proteus* and *B. pyocyaneus* are not susceptible and other agents are required for the prevention and treatment of Monilia. Proprionates and caprylic acid derivatives are widely used for the latter, although gentian violet solution continues to be the most effective remedy.

Excoriations and ulcerations of the labia and vulva secondary to vaginitis respond well to hydrocortisone ointment, 1 or 2½ per cent. Locally prepared ointment using the tablets and a water-soluble base have given most satisfactory results.

SARCOMA BOTRYOIDES*

ROBERT N. CREADICK, M.D., DURHAM, N. C.

THESE rare tumors have excited a sustained interest because of their extraordinary appearance, universal fatality, occurrence principally in very young girls or female infants, and the frequent inclusion of heterologous elements. Further noteworthy points concern the nomenclature, the ontogeny, the history and first descriptions of these tumors, methods of diagnosis and treatment, and much that is apochryphal, inaccurate, or confusing in the descriptions, quotations, and pathogenesis. All of these points will be briefly discussed.

Nomenclature.—Grapes, strawberries, and "a bunch of currants" are all terms that have been used to describe these tumors. Although numerous writers have attributed the term grapelike to Spiegelberg in 1879, the use of the term *traubige Sarkom* for this whole group of tumors should be attributed to Pfannenstiel.[12] In one case report,[18] Spiegelberg uses the interesting term *Weinbeeren.* Joseph McFarland[9, 10] in two monumental papers (one of these containing 516 references!) made the comment that some authors have considered the soft botryoid tumors a variety in themselves, but this grapelike appearance resulted only from the amount of moisture which the tumor happened to contain. These tumors have also been supposed to be peculiar to infancy, or at least early childhood, but this also is untrue (Fig. 1). They are "mixed tumors," but cannot be called mesodermal, as will be later explained.

Previous Reports of Cases.—As is so frequently found, more than one author should be given credit for the original description of the tumor. Spademan, Cohen, and Girton[17] gave the credit to Wagner[22] of Leipzig in 1854. His case was evidently a chondrosarcoma of the uterus, not cervix or vagina, in a woman of 55 years. McFarland gave credit to M. P. Guersant[5] in exactly the same year, and qualified his choice by stating that earlier compilers accepted Guersant's case because the description was evidently detailed and accurate enough. This latter case was apparently a tumor of the vulva in a child. To quote concerning case reports from McFarland,[9] whose words are as cogent now as they were 40 years ago:

"It is extremely unfortunate that the desire to report a rare case so often leads to its publication before knowledge of it is perfected. The case appears at the clinic, is recognized as a rare affection, an ingenious operation is performed, and the patient recovers from it. The clinician then hastens to report the case and tell what has been done without waiting to learn what the final outcome was to be. The evils of this practice are well shown by the tabulation showing the 'Fatality of the Different Histological Forms of Sarcoma Vaginae Exclusive of Sarcoma Botryoides Vaginae,' where out of a total of 58 cases, the

*Presented at the Sixteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Hollywood Beach, Florida, Jan. 14, 15, and 16, 1954.

termination of the affection is unknown in 34. It is likewise unfortunate that histological examinations have not been made in all cases."

Ontogeny.—The origin and development of these tumors are still uncertain. For almost 100 years, however, lively discussions and arguments have occurred in the literature, as well as on the rostrum, in regard to the proposed theories.

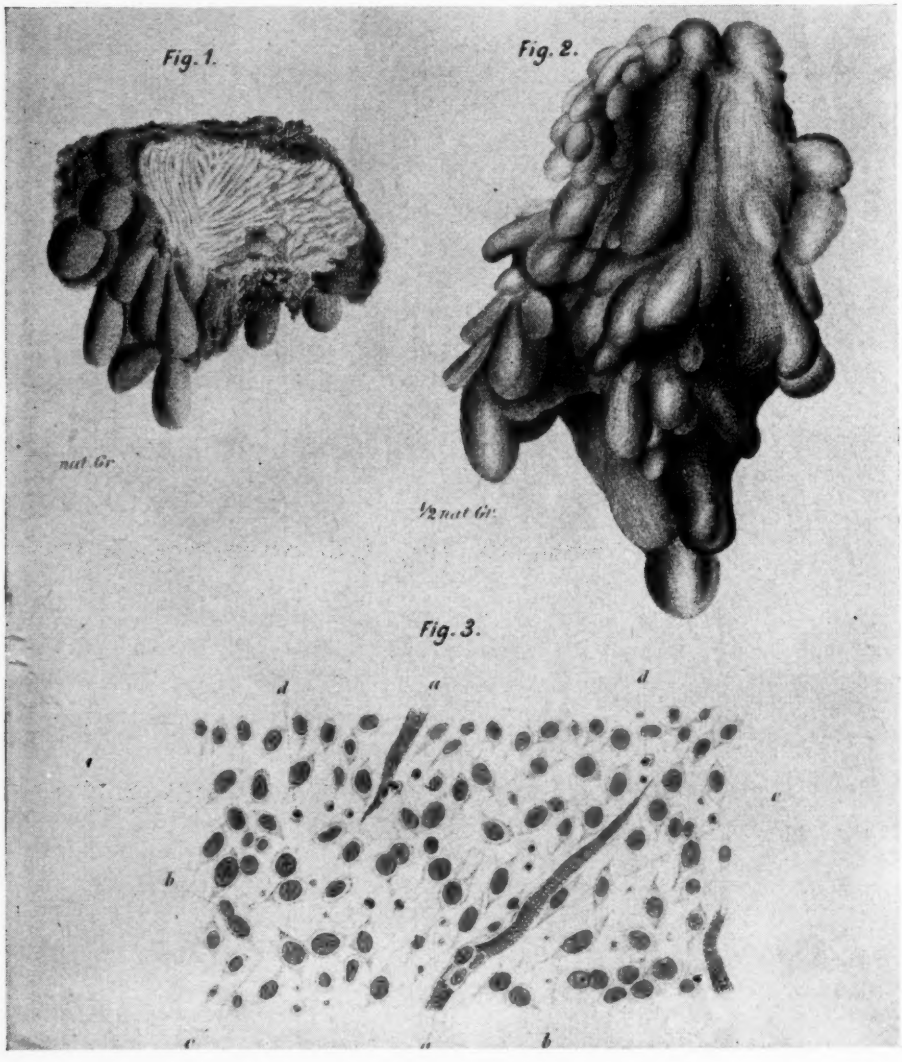


Fig. 1.—Drawing of botryoid tumor in a young girl. (From Spiegelberg, O.: Arch f. Gynäk. 14: 178, 1879.)

It seems fairly certain now that the term sarcoma botryoides is actually a misnomer, and we should adopt McFarland's suggestion of using "dysontogenetic" for most of the tumors of this region. The terminology has certainly been bewildering with 119 different names, including sarcoma botryoides and the tongue-twisting term, "myxoma enchondromatodes arborescens colli uteri." In the search for etiology, opinions were produced by Ahlseld, Hauser, and

Kolisko on one hand, and Cohnheim and McFarland on the other. Pfannenstiel even had a theory of his own in regard to the origin of the tumor from the endothelium of the blood and lymph capillaries. Wilms[24] and Schwalbe have done much to clarify the terms and the theories. The idea of metaplasia has been much overworked, and probably has no place in the argument. There has been great diversity of tissue in these tumors, and the term teratomas would not be too foreign. The fact that both the very young and the postmenopausal groups have been included further favors the theory of "embryonic vestiges" of Cohnheim. Only one botryoid tumor has been reported with adult nerve tissue, which is certainly heterologous. Bone, fat, cartilage and muscle—even striated muscle, which is most difficult to demonstrate,[7] have been reported. In one instance, the tumor developed in intrauterine life, and the oldest patient reported was 69 years of age. It is curious that almost all of the simple botryoid tumors of the vagina have occurred before the age of 20. Apparently, these tumors are truly embryonal dislocations—in other words, dysontogenetic (Fig. 3, *A* and *B*).

Diagnosis and Treatment.—As we have mentioned, the term sarcoma botryoides refers to a gross diagnosis of the appearance of the lesion in the vagina, or through the vulva. The sites of origin most frequently are the anterior lip of the cervix, or the upper vagina. They must necessarily be differentiated from sarcomatous elements arising from the uterine corpus itself. These also can be fleshy, polypoid, and vesicular, or grapelike. The beautiful account by Spiegelberg in 1879 pays tremendous attention to detail. The description of the cellular elements is very accurate. A part of it is herewith translated:

"As to the significance of the neoplasm, we have to consider the large cells which are located irregularly in the intracellular substance, as these are often connective tissue in nature, and the whole neoplasm therefore resembles sarcoma. The intracellular substance has undergone change (it became light and transparent, and the interstices partially broadened), a change which microscopically, as well as macroscopically, reminds us of myxosarcoma. The acetic acid reaction proposes such an assumption, as well as the occurrence of lymph cells in the content; therefore, it can only be the inter-relation of a liquid lymphoid mass between the cells.

"One could think of lymph vessel 'ectasia' or lymphorrhagia into the substance, as may occur not infrequently in sarcoma of uterine myomata. At least I have seen them relatively frequently in these tumors, but the elements of the wall of the lymph vessel could not be found anywhere. The only assumption left is that we are dealing with an infiltration of the sarcomatous tissue by lymphatic fluid in hydropic fashion.

"The origin of this edema can easily be explained by the extent of the tumor, the substance of its tissue, and the abundance of lymph sinuses in the cervical mucosa. The latter circumstances seem to be decisive. In solid tumors of this region, such edema does not occur. By the way, the present observation is not new. Among the cases of sarcoma which I saw previously and which have been described by Kunert in this Archive (see page 111), the fifth (the seventh in my cases), showed the same behavior. It says on page 113 that the vagina is dilated with large, tough, jelly-like masses, which adhere like the cells in a blood coagulum. These masses originate at the external os which is elevated and superficially infiltrated. Although they are very fragile, they adhere tightly to their bases. They look like postmortem clot. Thus, up to now, of only a few cases of cervical sarcoma reported, two out of four showed hydropic degeneration. The present tumor shows further characteristics to produce polypi and papillary extensions, the formation of

which was certainly caused by the abundance of papillae in the lower cervix, and most probably by the gland-like impressions on the surface of the tumor. In this way, there were first originated compact excrescences, and out of those, the occurrence of hydropic change, and apparently cystic formation similar to grapes, so very like the elements of a hydatid mole, that I thought when examining the patient for the first time I was dealing with such a mole. It is possible that these papillary extensions would have been a striking contrast, had I seen the patient later in the disease. Then, they would have offered a picture such as that described by Kunert—case No. VII.

"About our patient, I only want to report that after repeated recurrences and removal of the tumor on the cervix which always gave the same microscopic picture, the uterus was excised by Professor Freund in my hospital. This is the case of sarcoma which Freund mentioned in his former publication about his method operation. All details about this operation and the anatomical protocol have been reported by Dr. Brunzel. In order to complete the above anatomical description, as I mentioned once, Professor Ponfick told me about the findings at the time of removal:

" 'The mucosa of the uterus is separated into two distinctly divided groups of curiously boggy outgrowths which are separated by the much dilated internal cervical os. Those which are found in the neck are typified by their pendulous character which reminds us of a jelly-like or mucous polyp, by their amber color usually with a touch of dark red, and by their extremely soft content. They have a continuous surface of low follicular epithelial cells and consist of very vascular granulation-like tissue, most of which are packed, mostly without any intracellular substance, or they are carried by a serous fluid which, after incision, flows out easily. The young forms are frequently degenerated, voluminous granular cells are among them, and also the thin vascular walls frequently show fatty degeneration.

" 'The body of the uterus is greatly enlarged. Its mucous membrane is velvety and bulging, somewhat edematous, and has in its lower portion a row of vesicular, encircling outgrowths which protrude into the internal cervical os. Although being soft and juicy, they are not jelly-like and they are more pale than the cervical outgrowths. They too possess an epithelial lining and are analogous to the layer of large round cells, but much fewer. This is followed externally by an entangled layer of bundles of young smooth muscle cells between which the round cells pass through, so that the tumor appears clearly to have invaded the muscle layers. There were no glands in all the outgrowths.'

"In regard to the course of the cervical sarcoma, I finally call attention to the girl of very young age, and to the much slower progress compared with the case cited by Kunert. Metastases were not completely absent, although they were found only occasionally in the peritoneum." (Translation—courtesy Dr. Ernest Peschel.)

The original drawings have been reproduced for historical interest. There is a tremendous contrast produced between these and the drawings of Max Brödel (from Kelly-Noble, Fig. 2) and the beautiful photographs of the gross tumor in the article by Spademan and associates[17] published just a year ago. Even more impressive are the photomicrographs of Liebow and Tennant[7] of the histology and of tissue culture. The tumors are frequently suppurative and necrotic, making Papanicolaou studies tedious because tumor cells are sparse in the large amount of debris and white blood cells.[3] They frequently distend the vagina enough to produce urinary retention, as in one of our patients, and eventuate frequently in local recurrences, urinary obstruction, and death. Local removal has universally been followed by rapid recurrence. Usually, this will be of the same gross picture, although it may vary. Histologically, the tumor shows spindle cells, round cells, and interlacing fibrils of thin con-

nective-tissue cells. A gray, myxomatous, or edematous fluid is almost always present. The presence of primitive muscle cells has led to the use of the term rhabdomyosarcoma. Careful scrutiny of all of these tumors is frequently rewarded by the finding of heterologous elements. Another aid to diagnosis would certainly be colpocytolgy. In two of our patients the Papanicolaou cancer stains were strongly positive for malignancy, although they were interpreted as squamous carcinoma (Fig. 3, *A* and *B*). It is hoped that more and more gynecologists will apply this technique, since it can certainly be performed even on a newborn female infant without trauma.[2]

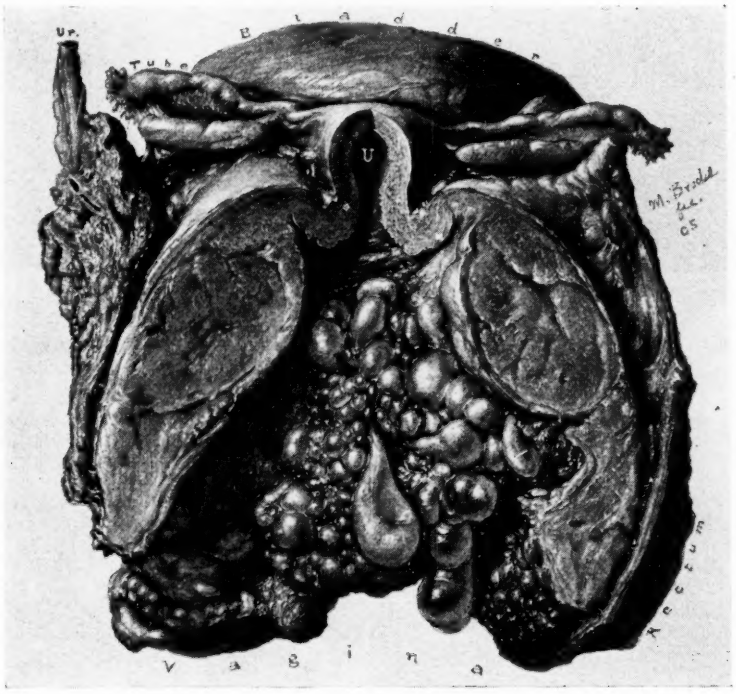
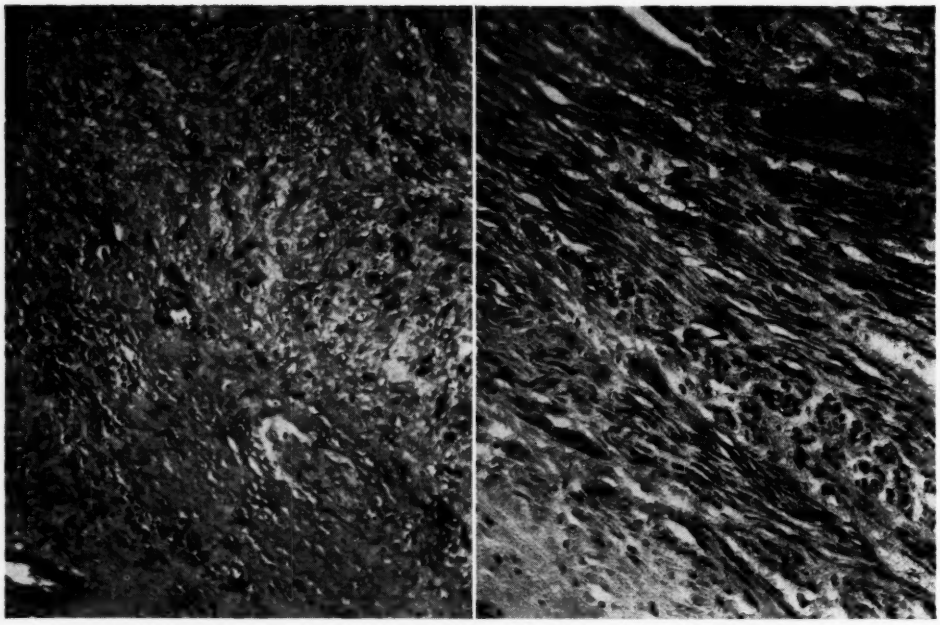


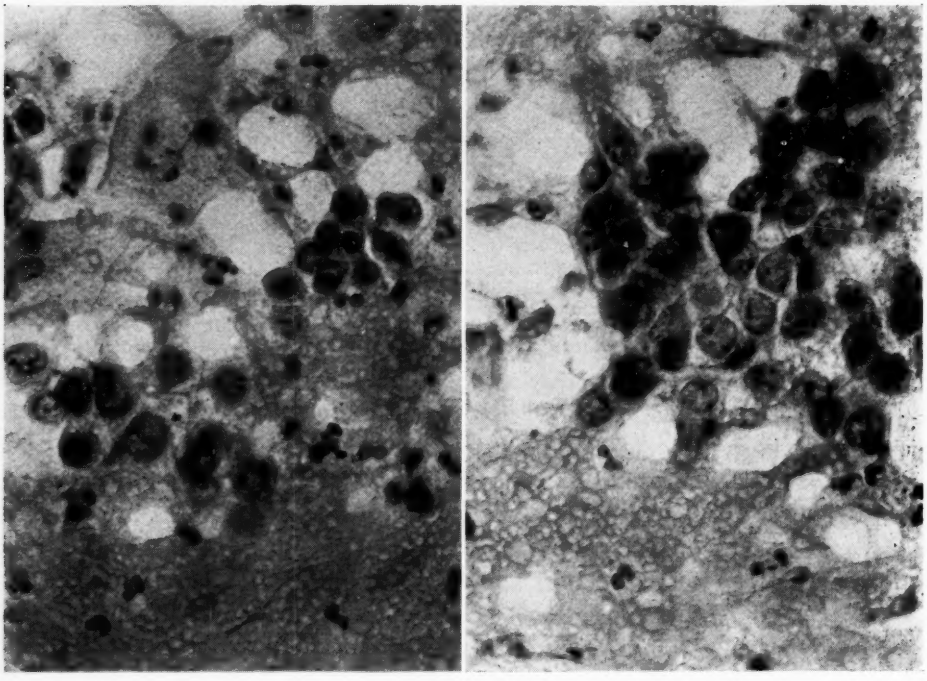
Fig. 2.—Typical dysontogenetic tumor. (From Kelly, H. A., and Noble, C. P.: Textbook of Gynecology and Abdominal Surgery, Philadelphia 1908, W. B. Saunders Company.)

Local excision has been discarded as a method of treatment. Several patients are on record to whom irradiation was given, but without any marked success. The average survival rate has been 18 months to 3 years. An extraordinary report by Shackman[14] in the *British Journal of Surgery* reports the case of a child of 4 years with sarcoma botryoides treated in 1947 by surgical excision of the vagina, uterus, bladder, and urethra, and transplantation of the ureters into the colon. The child was alive, and apparently very well at least 2½ years following the operation. He established the point that since local recurrences of the growth are much more common and spread by metastasis to distant organs rather rare, there might be a place for radical surgery in treatment of this disease. In addition, he mentions the case operated on by Meigs[8, 21] in the same year. Thirty-five years before the operations performed by Shack-



A. *B.*

Fig. 3, *A* and *B*.—Nuclear elements and muscle tissue. (Phosphotungstic acid stain.)



A. *B.*

Fig. 4, *A* and *B*.—Colpocytology showing malignant cells. Upper right central area of *A* shows what should be fairly typical cell of squamous carcinoma.

man and Meigs, a few of the continental surgeons had realized the possibility of radical surgery, but their patients did not survive. There are very few reports of distant metastasis, one to the brain reported by Friedland,[4] one to a kidney, and several to the bone and lung. In a clinical study, Thornton and Carter[19] in 1951 presented the case of a child living 3½ years without recurrence following x-ray therapy. The literature contains one report of irradiation with 7 years' survival, but final demise from recurrence.

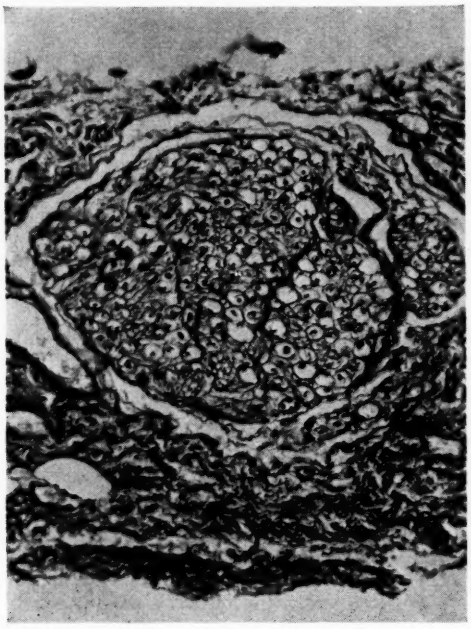


Fig. 5.—Adult nerve tissue from same tumor as in Fig. 3.

Collected Protocols.—Five patients with sarcoma botryoides have come under observation in the last 25 years at Duke Hospital. One patient was 52 years of age, the other four were under the age of 20. Unfortunately, in every instance the local physician failed to realize the seriousness of the lesion. One prescribed douches, another treated the patient for venereal warts. The others gave either hypodermic or oral medication in an effort to control the bleeding. No outside Papanicolaou smears were obtained, and only one biopsy was done. The average delay before hospitalization for attempts at definitive therapy was 9 months. None of the patients survived longer than two years (Fig. 5).

Summary

1. An attempt has been made to clarify certain parts of the historical background of the so-called "sarcoma botryoides."

2. It is suggested that the term dysontogenetic, mixed tumors of the urogenital sinus, as reqested by McFarland, be used rather than a descriptive term plus the word sarcoma. The term mesodermal should not be used when

obvious epithelial elements and myelinated nerve tissues have been observed; multipotential anlagen would provide the best solution.[7]

3. A plea is made for better diagnostic efforts, despite the rarity of the tumor, and inclusion of the Papanicolaou stain technique.

4. A few of these patients might be amenable to radical surgery in hope of a cure. Meigs' patient, now 6 years postoperative,[13] is still living.

5. Five additional patients are reported; one of the neoplasms seems to contain adult nerve tissue.

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Discussion

DR. EDWIN RUCKER, Richmond, Va.—Dr. Creadick has brought us a discussion of a rare and interesting tumor. His plea for earlier diagnosis is timely. These patients fall in the age group attended chiefly by the pediatrician and the family physician. It seems necessary to bring this to the attention of these groups if earlier therapy is to be had. I doubt, however, if the profession will be able to find enough trained cytologists for routine Papanicolaou smears on all newborn infants. This suggestion, if carried to its conclusion, would involve regular "follow-up" studies on these females for twenty years. The suggestion of a more radical surgical attack than mere local excision may mean the difference between success and failure in treatment of this lesion.

This tumor has been classified among the dysontogenetic tumors of the urogenital region. Dysontogenesis is a term expressing accidents of development that may be followed by malformation or tumor occurrence. These tumors have been called by many names, Dr. Creadick citing McFarland's reference to some 119 different terms. Dysontogenetic tumors have no standards of histological structure. They are often spoken of as "mixed tumors," but how "mixed" does a tumor have to be, to be so classified?

If one recalls the cellular characteristics of the early embryonal tissues forming the genital structures and pictures the various consequences that might result from the accidental wandering of some of the cells in their developmental elongations, fusions, and multiplications, their growing importance at one time and waning significance at another, it may appear more remarkable that development proceeds in an orderly manner than that it should occasionally result in dysontogenesis. That this tragic tumor is rare, we all know. It is remarkable that Dr. Creadick has five cases to report. I am unable to find a single case recorded at the Johnston Willis Hospital or at the Medical College of Virginia. The Surgical Pathology Department at the Medical College of Virginia also has no record of such a case. I cannot believe the diagnosis of this generally fatal malignancy is being missed in our town, for fatal cancer, like both pregnancy and murder, will eventually be manifest even to the slowest of us.

DR. FRANK R. SMITH, New York, N. Y.—In 1952, Hardy and Moragues reviewed the literature on this subject in great detail. They found only 95 authenticated cases reported to 1941 and 19 additional cases reported from 1941 to 1952, making a total of 116 cases by 1952. Wilson, Thornton, and their co-workers presented this subject before this Society last year at Havana under the title of "Mixed Mesodermal Tumors of the Uterus." They included any tumors which contained a combination of mesodermal tissues.

The incidence of these relatively rare tumors will vary somewhat according to the rigidity of the criteria used for classification. Some tumors may fail to present either the classical gross "botryoides" or clusterlike appearance, yet microscopically meet the pathologic definition.

All writers are agreed that the co-existence of carcinoma and sarcoma in the same uterus does not necessarily constitute a carcinosarcoma but may merely be a "collision" tumor of two growths with separate origins. Other tumors may belong rather in a "combination" group in which the sarcoma part is really only extensive stromal infiltration, which under certain conditions changes its morphology to resemble sarcoma. By strict pathologic definition, probably the only true mixed tumors are the "composition" tumors in which both the carcinomatous and sarcomatous elements arise from the same type of stem cells. This is often difficult to determine because of the advanced stage of the disease when the patient is first seen.

Until we have better knowledge of these tumors, I doubt if we can completely discard the theory of metaplasia as advanced by Pfannenstiel, nor should we irrevocably accept the cell inclusion theory of Cohnheim. Well known is the fact that the mesoderm of the genital tract can differentiate into epithelium as well as into connective tissue. This is suitably illustrated in the making of an artificial vagina without skin grafts but by maintaining the presence of a foreign body inserted into the artificial vagina. The epithelial lining of the vagina is by metaplasia and not by projecting epithelial growth. It is not hard to visualize mesodermal tumors under certain conditions behaving similarly.

Formerly, sarcoma botryoides was considered to occur only in children or girls under 20 years of age. With each new series of mixed tumor reports, some older patients are included. At Memorial Hospital, we have had less than 20 patients with tumors of the genital tract that were classified as mixed tumors.

Irradiation has been of no benefit in this disease. Radical surgery may offer some hope but with the same restrictions and limitations that should govern radical surgery elsewhere.

THE NONOPERATIVE TREATMENT OF INEVITABLE AND INCOMPLETE ABORTIONS*

A Study of 454 Cases

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ABORTIONS are among the most frequent complications of pregnancy. In many respects it is more difficult to supervise the completion of an abortion than it is to manage the delivery of a full-term infant.

Two methods have been suggested for the management of abortions in the first half of pregnancy. One of them allows the abortion to take place without the use of operative intervention although it employs oxytocics to speed the expulsion of the products of conception and to decrease the amount of the blood loss. According to the other plan of treatment, the abortion is completed by operative methods, usually a curettement of the uterus, as soon as the patient's condition permits after she is admitted to the hospital.

The purpose of this study is to determine the advantages and disadvantages to be expected if the nonoperative method of treatment is used to complete an inevitable or incomplete abortion. The report consists of an analysis of the records of 454 patients who aborted during the first twenty weeks of gestation at Grady Memorial Hospital between April 1, 1947, and May 31, 1951. The study includes only those cases admitted to the hospital. The patients were treated under the supervision of the Department of Obstetrics and Gynecology of the Emory University School of Medicine. During the years of this report, 21,568 live births occurred in the hospital. All of the patients at Grady Memorial Hospital are service cases. Approximately 75 per cent of the obstetrical patients in the hospital are Negro and the other 25 per cent are white. The incidence of abortion was essentially the same for the Negro and for the white patients.

The abortion was considered to be inevitable if the patient had (1) uterine contractions occurring every five minutes or less, (2) progressive dilatation and effacement of the cervix, (3) rupture of the amniotic sac, or (4) uterine bleeding increasing to the extent that it was more than twice as profuse as the patient's normal menstrual flow or that blood clots were being passed which were 4 cm. or larger in diameter. A patient was classified as being admitted with an incomplete abortion if the examination of the products of conception delivered in the hospital revealed that a portion of them had been aborted earlier.

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Plan of Treatment

One of the basic reasons for employing the nonoperative method of treatment for abortions on our service was the acute shortage of available beds for obstetrical patients at Grady Memorial Hospital. If the patient was not septic and if she was in good condition when she was seen in the emergency clinic, an attempt was made to complete the abortion at that time. If the abortion was completed successfully, the patient was dismissed without being admitted to the hospital.

In the emergency clinic, if the patient's condition was good, she was given 0.5 c.c. of pituitary extract subcutaneously at thirty-minute intervals for four injections. Unless the products of conception had passed spontaneously by that time a combined rectal and abdominal examination was performed during which an attempt was made to expel the products of conception by means of simple expression. Approximately two-thirds of the inevitable and incomplete abortions were completed in the clinic by this procedure and the patients were sent home without being admitted to the hospital.

If a patient showed signs of sepsis, excessive blood loss or shock, or if the abortion could not be completed in the emergency clinic, the patient was admitted to the hospital. She was then brought into good condition as quickly as possible by the use of blood transfusions, clyses, and antibiotics as indicated. Morphine was usually administered. As soon as the patient's condition was satisfactory another course of four injections of 0.5 c.c. of pituitary extract subcutaneously was begun. If the products of conception had not been expelled within one hour after the last injection, an aseptic vaginal examination was made without an anesthetic. (If the patient was bleeding actively at the time of admission, the vaginal examination was made as soon as her condition permitted.) The cervix was visualized by means of a speculum. Sponge forceps were used to remove any products of conception which could be seen in the vagina or cervix. The uterine cavity was not explored with sponge forceps or otherwise.

The patients whose abortions were not completed by these procedures were given an Ergotrate tablet orally every four hours for six doses. At the end of that time another course of four injections of pituitary extract was given, followed by another aseptic vaginal examination. If the products of conception could not be seen, the course of Ergotrate followed by the pituitary extract was repeated once more. If the products of conception could not yet be seen by speculum examination, the patient was kept under observation in the hospital for four or five days. Active bleeding at any time was an indication for a vaginal examination. In such cases, the products of conception could usually be visualized and then removed easily. However, if the bleeding subsided during the period of observation and if the size of the uterus and other signs were compatible, the abortion was considered to be complete and the patient was discharged. If the abortion was actually incomplete in such a case, it would sooner or later produce bleeding or infection and require the readmission of the patient to the hospital.

Results

The results from the nonoperative plan of treating inevitable and incomplete abortions are summarized according to the problems encountered in managing these patients. (1) The interval between the admission of the patient to the hospital and the completion of the abortion is an important consideration. (2) The effectiveness of any method of treating abortions must be studied with reference to the complications of infection and hemorrhage. (3) From the practical standpoint, the total length of the hospitalization for the patient is of importance. (4) The complications which develop after the patient's admission to the hospital should be considered as to type and frequency. (5) The reasons should be studied as to why some of the abortions could not be completed successfully by the nonoperative methods.

From the information on these subjects it should be possible to determine the advantages and the disadvantages of the nonoperative method of treatment. In studying our results, it should be remembered that approximately two-thirds of the inevitable and incomplete abortions at Grady Memorial Hospital were completed successfully and the patients were discharged without being admitted to the hospital. The 454 abortions discussed here were the ones which could not be completed safely without hospitalization.

The Time of the Completion of the Abortion.—

The abortion was completed within the first twenty-four hours after admission in 399 of the 454 patients. The completion of the abortion was spontaneous in 38 cases, it occurred after the injections with pituitary extract in 71 cases, and the completion was accomplished in 290 women at an aseptic vaginal examination with the use of sponge forceps to remove the products of conception from the vagina or from the external os of the cervix.

The completion of the abortion required over twenty-four hours after admission for 51 patients. Twenty-one of these women had been admitted as having threatened abortions and they were hospitalized for variable lengths of time before it became evident that the abortion was inevitable.

Four patients died with the abortion incomplete. Including these 4 women, a total of 9 patients with abortions died during the years included in this report.

Infection.—

A patient was classified as being infected, or septic, if her temperature was 100.6° F. or above on one or more occasions during her hospitalization; if she had a definite parametritis, pelvic cellulitis, or peritonitis regardless of her temperature; or if a history was obtained that the abortion had been criminally induced. According to this definition, 313 patients (68.9 per cent of the 454 cases) were not infected at the time of their admission while 141 patients (31.1 per cent) were infected at that time.

A study of the 313 women who were not infected at the time of admission revealed that 279 of their abortions (89.1 per cent) were completed within the first twenty-four hours after admission. Sixteen of the remaining cases were completed on the second day, while 18 patients required more than two

days before the abortion was completed. Eleven of these 18 patients had been treated as having a threatened abortion for twenty-four hours or longer after their admission.

The abortion was completed within the first twenty-four hours in 120 (85.1 per cent) of the 141 women who were septic at the time of admission. These 120 septic patients included 79 women who were febrile for less than twenty-hour hours; only 15 of them were febrile longer than forty-eight hours. The 21 cases which were not completed within the first twenty-four hours included 12 women who required over forty-eight hours to complete the abortion and the 4 women whose abortions were not completed before they died.

The 141 patients with infection at the time of admission included 41 (9.0 per cent of the 454 patients) who admitted that their abortions had been criminally induced. The physical findings and the course in the hospital indicated that many more of the abortions were probably criminally induced in spite of vigorous denials on the part of the patients. Eleven of the 41 criminal abortions required over twenty-four hours to be completed.

Antibiotics, often combined with sulfonamide preparations, were used in the treatment of all except 32 of the patients who were classified as infected. The only patients who were not given antibiotics were some of the women whose abortions were completed shortly after admission. The antibiotics were occasionally omitted in such cases if the patient became afebrile after the completion of the abortion and if the only sign of infection had been the elevated temperature.

Hemorrhage.—

Transfusions were given to 191, or 42.1 per cent, of the 454 patients. The 191 women received a total of 415 units of whole blood or plasma. Twelve patients had minor transfusion reactions but no serious reactions occurred. The number of patients transfused and the number of units of blood administered seem to be relatively high until it is recalled that approximately two-thirds of the women who came to the hospital with inevitable or incomplete abortions had their abortions completed successfully without being admitted to the hospital. As mentioned previously, the excessive loss of blood associated with the abortion was one of the indications for which the patients were hospitalized.

As seen in Table I, transfusions were required by more of the patients who were septic at the time of admission than were required by the ones who were not septic. Transfusions were given to 82 (58.2 per cent) of the 141 septic patients as compared with transfusions given to 109 (34.8 per cent) of the 313 nonseptic patients. The average number of transfusions per patient was almost exactly the same in both the septic and the nonseptic cases. The 82 septic patients received 184 transfusions while the 109 nonseptic ones received 231 transfusions.

The length of time required to complete the abortion after the admission of the patient did not seem to affect the number of patients requiring transfusions nor the average amount of blood needed in each case. A total of 378 units of blood or plasma were administered to 171, or 42.9 per cent, of the

399 septic and nonseptic women whose abortions were completed within the first twenty-four hours after admission. A total of 37 units of blood or plasma were given to 20, or 36.2 per cent, of the 55 patients whose abortions were not completed within the first twenty-four hours.

The presence of shock among the patients in this study was determined by the clinical evaluation of the patient's blood pressure, pulse, and general condition. Shock was recognized in 86 of the women, including 6 of the patients who died. The development of shock seemed to be associated with hemorrhage and infection. All of the patients with shock received transfusions. Infection was present in 37 of the patients with shock, including the 6 women with shock who did not survive.

TABLE I. DISTRIBUTION OF TRANSFUSIONS

	TOTAL NO. OF PATIENTS	NO. OF PATIENTS TRANSFUSED	% OF PATIENTS TRANSFUSED	NO. OF TRANSFUSIONS GIVEN	AVERAGE NO. TRANSFUSIONS PER PATIENT
Patients not septic on admission	313	109	34.8	231	2.1
Completed within 24 hours	279	102	36.7	215	2.1
Not completed within 24 hours	34	7	20.6	16	2.3
Patients septic on admission	141	82	58.2	184	2.2
Completed within 24 hours	120	69	57.5	163	2.4
Not completed within 24 hours	21	13	61.9	21	1.6

An interesting observation in our study concerned the condition of the cervix of the patients who had had appreciable hemorrhage. If a pelvic examination was made during or after the hemorrhage, the cervix was usually found to be dilating and the products of conception could usually be seen in the external os of the cervix or in the vagina. The products of conception could be removed easily at that time and the abortion completed. This situation was found to be present in 160 of the 191 patients who required transfusions. The patients whose abortion could not be completed by the nonoperative method at the first pelvic examination after admission were kept under observation in the hospital. If active bleeding began, another pelvic examination nearly always revealed the products of conception to be in the external os of the cervix or in the vagina.

Length of Hospitalization.—

One of the most important practical features in the evaluation of any method of treatment for inevitable or incomplete abortions is the length of the hospitalization which is required for the patient. In our report the entire time spent in the hospital is considered as the length of the hospitalization, even though 21 patients were treated initially in the hospital as having threatened abortions. The policy of the obstetrical service during the years of this study was that a patient should be hospitalized for at least five days if her condition was such that the abortion could not be completed and the patient discharged

from the emergency clinic with reasonable safety. The five-day period of hospitalization was felt advisable to ensure adequate therapy for the criminal abortions and other infected cases as well as for the patients who had had excessive blood loss. In view of this policy, very few patients were dismissed from the hospital in less than five days after admission.

The length of the hospitalization was best correlated with the time at which the abortion was completed. As seen in Table II, the 399 septic and nonseptic patients whose abortions were completed within the first twenty-four hours in the hospital had a total period of hospitalization of five days or less in 211 cases (52.9 per cent). They had a hospitalization of eight days or longer in 97 cases, or 24.3 per cent. By contrast, the 51 septic and nonseptic patients whose abortions were completed after the first twenty-four hours had a period of hospitalization of five days or less in 14 cases (27.5 per cent). They were hospitalized for eight days or longer in 27, or 52.9 per cent of the cases.

The comparison of the length of the hospitalization of the septic patients with that of the nonseptic does not show as much variation. The 313 nonseptic patients had a period of hospitalization of five days or less in 169 cases (54.0 per cent), and of eight days or more in 74 cases (23.6 per cent). Fifty-six of the 137 septic patients had a period of hospitalization of five days or less (40.9 per cent) and 50 had a hospitalization of eight days or more (36.5 per cent).

TABLE II. LENGTH OF HOSPITALIZATION

	PATIENTS NOT SEPTIC ON ADMISSION				PATIENTS SEPTIC ON ADMISSION*				TOTAL	
	COMPLETED WITHIN 24 HOURS		COMPLETED AFTER 24 HOURS		COMPLETED WITHIN 24 HOURS		COMPLETED AFTER 24 HOURS			
DAYS IN THE HOSPITAL	NO. OF CASES	% OF CASES	NO. OF CASES	% OF CASES	NO. OF CASES	% OF CASES	NO. OF CASES	% OF CASES	NO. OF CASES	% OF CASES
5 days or less	157	56.3	12	35.3	54	45.0	2	11.8	225	50.0
6 or 7 days	62	22.2	8	23.5	29	24.2	2	11.8	101	22.4
8 days and over	60	21.5	14	41.2	37	30.8	13	76.4	124	27.6
Total	279	100.0	34	100.0	120	100.0	17	100.0	450	100.0

*Does not include the 4 patients, septic on admission, who died with the abortion still incomplete.

The length of hospitalization for the patients who required transfusions as contrasted with those who did not also fails to show as much variation as was found in regard to the time after admission at which the abortion was completed. If the 4 patients who died before the abortion was completed are omitted, 187 women were transfused. Their hospitalization was five days or less in 62 cases (33.2 per cent) and it was eight days or longer in 66 (35.8 per cent). No transfusions were given to 263 patients. The hospitalization was five days or less in 163 (62.4 per cent), and it was eight days or longer in 58 (22.1 per cent).

Complications After Admission.—

The complications which developed, or which increased in severity, after admission were associated with infection or hemorrhage and shock.

The 313 patients who were not classified as infected at the time of their admission included 20 who later became septic. Although the condition of the 20 patients did not cause them to be designated as infected at the time of admission, yet 13 of them had elevated temperatures ranging from 99.6 to 100.4° F. when they entered the hospital. After admission their temperatures became 100.6° F. or higher and they were then classified as infected. Fifteen of these 20 abortions were completed within the first twenty-four hours after admission. The only specific infection which developed among the 20 women was one case of pyelonephritis.

The specific types of infection which occurred among the 141 septic patients at the time of admission were: parametritis in 17 cases, tuboovarian abscesses in 2 cases, pelvic peritonitis in 3 cases, and pyelonephritis in 1 case. Almost all of these complications were already present at the time of the patients' admission to the hospital. Nine additional septic patients died and their records are summarized later. The infection in the remaining 109 patients consisted of an endometritis or else did not show any definite localizing signs.

The amount of the blood loss after the patients were admitted was not measured accurately but it was estimated to have exceeded 300 c.c. in only 24 cases. In 9 of the 24 cases the excess bleeding was associated with shock which developed after admission. None of the 9 patients who died had appreciable bleeding after admission. Shock developed after entering the hospital in two of the patients who died (Cases 451 and 454), but in both women a generalized sepsis was present and the shock occurred terminally.

No definite correlation could be established between the development of complications and the length of the delay in completing the abortion after the admission of the patient to the hospital.

Failures of the Nonoperative Method of Treatment.—

The abortions were considered to be complete if the products of conception were visualized after they had been aborted and if the bleeding and other symptoms subsided. The patients on the obstetrical service at Grady Memorial Hospital have almost no other facilities available for hospitalization. It is fairly certain that all of the patients dismissed before the completion of the abortion would have been seen at this hospital if addition treatment had become necessary. The abortion was completed successfully by the nonoperative method in 417, or 91.9 per cent, of the patients.

Three women left hospital before the abortion was completed and did not return for additional treatment. The nonoperative method of treatment had to be abandoned in 5 patients because of profuse bleeding. The placenta was removed from the uterine cavity by the examining finger in 3 cases. The uterus was packed to control the excessive bleeding in 2 of the 5 cases.

A dilatation of the cervix and curettage was required to complete the abortion in 20 patients. The operative procedure was not required in any case as an emergency measure. It was employed in 12 women with incomplete abortions and excessive bleeding because of the inability to complete the abortion by the nonoperative method. The dilatation and curettage was done for diagnostic

purposes in 8 women with menorrhagia who had not given any history to indicate an incomplete abortion. The 8 patients had not been considered as obstetrical cases until the retained fragments of placental tissue were removed by the curettement.

Deaths From Abortion.—

During the years of this study 9 patients with abortions died on the obstetrical service. The findings in these deaths are summarized in Table III. The abortion had been completed before the admission of 2 patients.

TABLE III. MATERNAL DEATHS

CASE NO.	ADMISSION TEMP. (DEGREES F.)	CONDITION AT ADMISSION	COMPLETION OF ABORTION	TIME OF DEATH AFTER ADMISSION	AUTOPSY	CAUSE OF DEATH
236	102.2	Not critical B.P. 102/50 P. 130	Spontaneous on first day of 1st admission	10 days after second admission	No	Uterine culture: beta hemolytic streptococcus; generalized peritonitis
348	101.6	Critical B.P. 100/70 P. 125	Not completed	18 hours	Yes	Uterine culture: anaerobic streptococcus; peritonitis; septicemia
418	102 (rectal)	Critical B.P. 0/0 P. 140	Not completed	10 hours	Yes	Blood culture: hemolytic *Staphylococcus aureus,* coagulase positive; peritonitis (never out of shock)
449	104.2	Critical B.P. 70/40 P. 148	Spontaneous 10 hours after admission	3 days	No	Blood culture: gamma streptococcus; peritonitis (never out of shock)
450	97.8	Critical B.P. 100/60 P. 110	Completed before admission	20 hours	Yes	Blood culture: anaerobic streptococcus; purulent peritonitis; septic thrombophlebitis
451	101.0	Critical B.P. 140/80 P. 156	Completed before admission	11 days	Yes	Uterine culture: alpha prime streptococcus; generalized peritonitis
452	103.2	Semicomatose B.P. 100/60 P. 130	Not completed	20 hours	Yes	Blood and uterine cultures: *Cl. welchii* peritonitis (never out of coma)
453	101.2	Semicomatose B.P. 86/60 P. 132	Not completed	4 days	Yes	Peritoneal fluid culture: anaerobic streptococcus; purulent peritonitis; thrombophlebitis pelvic veins; pulmonary infarcts (never out of coma)
454	101.0	Not critical B.P. 100/70 P. 92	Completed at admission	13 days	Yes	Blood culture: hemolytic *Staphylococcus aureus,* coagulase, negative; bilateral cortical necrosis of kidneys

Case 450 was profoundly septic on admission. The urinary output during the twenty hours in the hospital was 80 c.c. Her nonprotein nitrogen on admission was 204 mg. per cent.

Case 451 gave a history of a criminal abortion five days before admission. The patient failed to respond to antibiotics and other therapy.

The abortion was completed for 3 of the women on the day of their admission to the hospital.

Case 236 completed the abortion spontaneously on the day of her first admission. She responded reasonably well to treatment and her temperature returned to normal in seven days. After being afebrile for four days she was dismissed. However, she returned in three days and was readmitted with a generalized peritonitis which did not respond to treatment.

Case 449 was acutely ill and in shock at the time of her admission. The patient did not respond to treatment and remained in shock throughout her course in the hospital.

Case 454 was admitted as having a septic abortion which was completed easily at the time of admission. Her temperature returned to normal on the day after admission and her course remained uneventful for the next eleven days. The day before her death her temperature dropped to 96.0° F. and remained subnormal. Shock developed terminally. The examination at autopsy revealed a bilateral cortical necrosis of the kidneys.

The abortion was not completed in 4 of the patients. At autopsy only a small amount of placental tissue was found in the uterus. The uterine bleeding after admission consisted of only slight spotting.

Case 348 had had a criminal abortion attempted seven days and again four days before admission. A generalized peritonitis was present when she was admitted and it failed to respond to treatment.

Case 418 was admitted in shock and in critical condition. All attempts at therapy were unsuccessful.

Case 452 had a *Cl. welchii* septicemia which ran a rapidly fatal course. The patient was moribund on admission and survived only twenty hours.

Case 453 was semicomatose and in shock at the time of admission. She had a generalized peritonitis which did not respond to treatment.

The primary cause of death in the 9 patients was infection. (The cause of the bilateral cortical necrosis of the kidneys in Case 236 was believed by the pathologist to have been a septicemia.) Four of the patients showed evidence of anemia, but it was severe in only one patient (Case 450). The blood loss after admission was minimal in all of the cases.

Comment

The abortion was completed within twenty-four hours after admission by the nonoperative method of treatment in 399 (87.9 per cent) of the 454 cases in this report. If the number of abortions completed successfully in the emergency clinic without admission of the patient to the hospital is taken into consideration, the abortions were completed successfully within the first twenty-four hours by the nonoperative method in approximately 95 per cent of the cases. The abortion was not completed successfully within the first twenty-four hours in 55 patients. Twenty-one of these had been treated as having threatened abortions for a time after admission and 11 of the others admitted that their abortions had been criminally induced. However, if the abortion had not been completed within the first twenty-four hours, it was not completed in 34 patients (61.8 per cent) until more than forty-eight hours after admission.

Excessive blood loss was encountered in 191 (42.1 per cent) of the 454 patients in this study and it was associated with shock in 86 cases. By means of adequate blood replacement, however, hemorrhage did not become a critical problem. Transfusions were required by a higher percentage of the septic patients than the nonseptic. Nevertheless, the development of the specific

types of infection such as parametritis, tuboovarian abscesses, and peritonitis could not be correlated with an increased requirement for blood transfusions. No increase in the number of patients requiring transfusions could be associated with a delay in completing the abortion after the patient was admitted to the hospital. Almost all of the women who had an episode of profuse bleeding were found at a pelvic examination to have the products of conception located at the external os of the cervix or in the vagina.

The length of the hospitalization of the patients in this series is a little longer than that reported by some of the other investigators employing either the operative or the nonoperative method for the completion of abortions. If the patients had been included in our series whose abortions were completed without requiring hospitalization, the average length of time in the hospital would have been quite short. The length of the hospitalization was most closely correlated with the time at which the abortion was completed after admission. The patients whose abortions were completed within the first twenty-four hours required five days hospitalization or less in 52.9 per cent of the cases. If the abortion could not be completed within the first twenty-four hours, 52.9 per cent of the patients was hospitalized for eight days or longer. The average period of hospitalization was increased to a less striking degree for the patients with infection or excessive blood loss.

The complications which developed after admission should be carefully studied for the evaluation of any method of treating abortions. Among the patients in this study, 20 became classified as infected after they were admitted, but 13 of them had had mild temperature elevations when they entered the hospital. No serious complication developed because of the infection in any of the 20 patients. Hemorrhage after admission was estimated to be over 300 c.c. in 24 women and in 9 of them the hemorrhage was associated with shock. The number of patients who developed shock after admission to the hospital is small but hemorrhage to that extent should not have been permitted.

The nonoperative plan of treatment had to be abandoned in 25 patients because of excessive or prolonged bleeding. In 5 of the patients the bleeding was profuse and had to be controlled without delay. It was controlled by removing the products of conception from the uterine cavity with the examining finger in 3 patients and the uterus was packed in the other 2 women. A dilatation of the cervix and curettage was performed upon 20 patients. The operation was not undertaken as an emergency measure in any of the cases but was used to control persistent and excessive bleeding in 12 women. It was performed on the gynecological service as a diagnostic procedure upon 8 patients with abnormal uterine bleeding who were not known to have had an incomplete abortion until fragments of placental tissue were found in the curettage specimen.

Infection was the major danger to the patients of this report. The 313 patients who were not septic at the time of their admission did not develop any serious complications. The prognosis was relatively good even in the infected cases unless they were in critical condition at the time of admission.

Only two patients (Cases 236 and 454) died from the complications of infection who were not critically sick at the time of admission. The abortion was easily completed shortly after the admission of both patients and both of them appeared initially to be responding satisfactorily to treatment. Only minimal bleeding occurred after they entered the hospital. It is unlikely that the fatal outcome would have been altered if the abortion had been completed by any other method of treatment.

We have continued to employ the nonoperative method of treatment for inevitable and incomplete abortions on our service at Grady Memorial Hospital since the end of the study period of this report on May 31, 1951. Since that time, through Dec. 31, 1953, only one patient with an abortion has died. She died in June, 1951, of a septic abortion. For the past thirty months we have had no deaths from abortion at Grady Memorial Hospital. During this time approximately 14,500 live births have occurred on our service.

Recent reports have shown that most patients with inevitable or incomplete abortions can be treated fairly satisfactorily by either operative[1, 2] or nonoperative methods.[3, 4] Our report is in agreement with the good results obtained by others using the nonoperative method of treatment. Our findings suggest that if the abortion has not been successfully completed within twenty-four hours by the use of the nonoperative treatment, consideration should be given to the use of operative methods to complete the abortion.

The nonoperative method of treatment offers specific advantages in addition to the ability to complete the abortion successfully. If an abortion is completed by means of a dilatation and curettage, an occasional threatened abortion might be curetted inadvertently. The nonoperative method of treatment does not require an anesthetic. This avoids the expense to the patient for the use of the operating room as well as for the charges of the anesthetist and of the surgeon. It does not involve the risks of anesthesia, with the possibility of death from the anesthetic. The nonoperative method of treatment avoids the possible danger of hemorrhage, trauma, and infection which might complicate operative procedures performed in cases of septic abortion, especially when criminally induced.

Summary

A study is made of the nonoperative method of treating patients with inevitable and incomplete abortions. By this method it was possible to complete the abortion in approximately two-thirds of the cases without admission of the patients to the hospital. The results obtained from the treatment of the 454 patients who required hospitalization are studied.

The abortion was completed within the first twenty-four hours after admission to the hospital in 399 of the cases. Infection was present at the time of admission in 141 patients, including 41 patients who admitted that the abortion had been criminally induced. Transfusions were given in 191 cases. The average length of hospitalization was shortest in the noninfected cases which did not require transfusions and which were completed on the day of admission to the hospital.

Complications which developed after the admission of the patient were encountered infrequently. Twenty patients became classified as infected cases after they had been admitted, but 13 of them had had mild elevations of temperature at the time of admission. No serious infections developed after admission. Hemorrhage estimated at more than 300 c.c. occurred in 24 patients while they were in the hospital.

The abortion was successfully completed by the nonoperative method in 91.9 per cent of the 454 patients. The nonoperative method of treatment had to be abandoned in 25 cases because of excessive or prolonged bleeding.

Infection was the major danger to the patients of this report. Even for infected cases the prognosis was good unless they were in critical condition at the time of admission.

The nonoperative method of treatment can be employed successfully in almost all patients with inevitable and incomplete abortions. The average length of hospitalization will be short and complications will rarely be encountered. The dangers of anesthesia and of surgical procedures are avoided. The expense of surgical operations and of operating room costs are not encountered.

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Discussion

DR. JOHN M. NOKES, University, Va.—The treatment of abortions has long been controversial and there are still many differences of opinion. Periodic evaluations of results are certainly desirable. The choice of the proper method of treatment of abortions still presents one of the challenges in obstetrics and gynecology.

The essayist has an enviable record in the emergency room treatment of abortions and we envy him for having such potent pituitary extract. I believe, however, that in such cases a gentle, sterile-glove pelvic and speculum examination should be made before any therapy is started. This is the only way to be certain that an ectopic gestation or threatened abortion is not present.

Outpatient treatment assumes that the proper blood matching has been done, for hemorrhage in abortion is so unpredictable that acute emergencies may be encountered. In order to prevent clinical shock it is necessary to offset blood loss and there is only one remedy and that is blood replacement as early as possible.

It would be impracticable to carry out this form of treatment in an area serving a rural and urban community in case it became necessary for the patient to return immediately should bleeding become alarming. We feel that in some instances it is difficult to determine when a spontaneous abortion is completed.

We have tried for some years at the University of Virginia Hospital to assume an intermediate position between the nonoperative and the operative methods. Our results have been satisfactory to us and, although I do not have the actual number of abortions treated in our hospital, I can say that from Jan. 1, 1941, to Dec. 31, 1952, there were 16,682 deliveries and only one maternal death from criminal abortion.

It is our policy to examine all patients suspected of having an inevitable or incomplete abortion and then to admit them to the hospital. Any existing anemia is corrected and fractional Pituitrin administered as outlined by the author. After observing the patient

for at least 24 hours, to determine the presence or absence of infection, if examination reveals the uterus to be no larger than twice normal size, a curettage is done if retained fragments are suspected.

One might consider the use of an intravenous Pitocin drip as a possible procedure in the cases that require hospitalization and it is conceivable that blood loss by this means might be lessened.

DR. JOHN J. MARSELLA, Danville, Va.—This paper is interesting from many viewpoints. To begin with, it shows that in the majority of cases of incomplete and inevitable abortion we may with reasonable safety follow a conservative policy and allow the abortion to resolve itself. A convincing argument is presented in favor of "medical curettage" over surgical curettage. Perhaps the greatest advantage of this mode of treatment is the conservation of hospital facilities and hospital services. In this day of high-cost illness this is a considerable factor.

We are in full agreement with the authors' emergency clinic treatment, though it is occasionally difficult to say that an abortion is complete, especially on rectal or rectoabdominal examination. However, if a patient is hospitalized when there is any doubt, the embarrassing experience of admitting to the hospital a woman in shock who a few hours ago was dismissed from the emergency clinic may be avoided.

We do, on the other hand, take issue with the hospital treatment of these cases which has been outlined. If an attempt at medical curettage has been unsuccessful in the emergency clinic and the patient requires hospitalization, we find little virtue in delaying surgical treatment, unless of course the patient's condition requires a delay. When we decrease blood loss, avoid the need for transfusions, and shorten the hospital stay by immediate surgical curettage we are performing a useful service.

At our hospital in Danville, Virginia, the majority of abortions are handled by four obstetrician-gynecologists and treatment is fairly well standardized. In the past five years among 734 incomplete and inevitable abortions, the average hospital stay in uncomplicated cases was three days and in cases complicated by hemorrhage and/or infection five days. Transfusions were necessary in one case out of six. That we have had only one maternal death during this five-year period is due probably to good fortune. We are not deterred by anesthetic risk when it is likely to be exceeded by bleeding risk.

THE RELATIONSHIP OF PRENATAL HEMOGLOBIN TO THE HEMOGLOBIN OF THE NEWBORN INFANT*

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INTEREST in the subject of the relationship between maternal prenatal hemoglobin levels and levels of hemoglobin in the newborn in our private practice arose from an observation that the majority of our patients seemed to be anemic. In routine hemoglobin determinations obtained during prenatal visits the most common finding was in the 60 to 70 per cent range. All of the patients were placed on the standard routine iron therapy, several of the usual trade preparations being used, with preference being given to those with the highest pharmaceutical recommendations. The maternal hemoglobin levels remained about the same. Some patients in the very low ranges remained very low throughout pregnancy. Others, who admitted not taking their medication, had high hemoglobin levels and these remained high throughout pregnancy. What effect, if any, this might have upon the baby became the subject of our investigation.

A review of the literature on hemoglobin in the newborn produced many conflicting reports. Oettinger[1] in 1949 found that the hemoglobin level of the newborn on the first day in a group of 24 patients averaged 20.3 Gm. when taken by heel puncture and 16.7 Gm. when taken by venepuncture. Smith[2] in 1947 gave the normal first-day hemoglobin as 18 to 22 Gm. Potter[3] reports the normal cord hemoglobin as 15 to 20 Gm. DeMarsh and associates[4] in 1941 in a comparison of infants in whom the cord had been clamped at once and those in whom the cord clamping had been delayed found that in 25 babies with each method the average hemoglobin for those with immediate clamping was 18.94 Gm. and with delayed clamping 21.6 Gm. The average maternal hemoglobin for these same patients was 12.26 Gm. in the first group and 13.04 in the second group. The so-called iron deficiency anemias in newborns and infants in the pediatric literature has been attributed in some cases to anemia of the mother.

A practical clinical approach to the question seemed to be that of obtaining the hemoglobin level of the mother on each prenatal visit and the hemoglobin level of her baby following delivery. The hemoglobin of the mother was obtained by finger puncture and read on a standardized Leitz photoelectrometer. The hemoglobin determination of the baby was obtained by heel puncture and read on an identical instrument. This was done in 176 consecutive cases. The mothers were divided into groups of average hemoglobin levels. Table I shows the number of hemoglobin determinations on the mothers and infants in each group. Table II shows the groups with the corresponding average infant hemo-

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TABLE I. TOTAL NUMBER OF DETERMINATIONS BY GROUPS

	GROUP I 50%-60% 7.85 GM. TO 9.80 GM.	GROUP II 60%-65% 9.80 GM. TO 10.15 GM.	GROUP III 65%-70% 10.15 GM. TO 10.90 GM.	GROUP IV 70%-80% 10.90 GM. TO 12.50 GM.	TOTAL	TOTAL
Maternal hemoglobin	88	488	797	179		1,552
Newborn hemoglobin						
First day	12	57	90	19	178	398
Third day	10	49	76	17	152	
Fifth day	2	25	34	7	68	

TABLE II. PRENATAL PATIENTS WITH CORRESPONDING NEWBORN INFANT HEMOGLOBIN

MATERNAL PRENATAL HEMOGLOBIN			NEWBORN HEMOGLOBIN			
	RANGE	NO. OF PATIENTS	FIRST DAY	THIRD DAY	FIFTH DAY	NO. OF PATIENTS
Group I (50%-60%).—	42%-64%	11	18.63 Gm.	18.65 Gm.	17.58 Gm.	12
Low 7.85 Gm.	Low 6.60 Gm.		Low 13.75 Gm.	Low 15.20 Gm.	Low 17.30 Gm.	
High 9.80 Gm.	High 10.00 Gm.		High 21.90 Gm.	High 20.75 Gm.	High 17.85 Gm.	
Group II (60%-65%).—	51%-78%	57	18.35 Gm.	17.89 Gm.	17.16 Gm.	58
Low 9.80 Gm.	Low 8.00 Gm.		Low 13.75 Gm.	Low 13.75 Gm.	Low 13.75 Gm.	
High 10.15 Gm.	High 12.18 Gm.		High 22.00 Gm.	High 21.30 Gm.	High 20.00 Gm.	
Group III (65%-70%).—	58%-78%	89	18.47 Gm.	18.12 Gm.	17.57 Gm.	90
Low 10.15 Gm.	Low 9.05 Gm.		Low 13.75 Gm.	Low 12.35 Gm.	Low 13.75 Gm.	
High 10.90 Gm.	High 12.18 Gm.		High 24.10 Gm.	High 21.30 Gm.	High 20.20 Gm.	
Group IV (70%-80%).—	60%-88%	19	18.53 Gm.	18.23 Gm.	16.52 Gm.	19
Low 10.90 Gm.	Low 9.30 Gm.		Low 13.70 Gm.	Low 14.25 Gm.	Low 12.80 Gm.	
High 12.50 Gm.	High 13.70 Gm.		High 21.90 Gm.	High 21.93 Gm.	High 19.00 Gm.	

globin. Average levels are shown together with the minimum and maximum determinations in each group. Although this is not an accurate picture for any single individual, it does show the general trend. The minimum and maximum figures were included to give a better insight into the individual findings.

It was felt that by obtaining the hemoglobin on the first, third, and fifth days a better blood picture of the newborn could be shown. The normal day of discharge from the hospital is the fifth postpartum day; the laboratory was frequently unable, therefore, to obtain blood counts on the babies on this day.

Since immediate and delayed clamping of the cord have been reported as a factor in relative anemia in the newborn, the patients were divided into two groups as is shown in Table III. In the first group of 103 patients the cord was clamped immediately upon delivery. In the second group of 75 patients the cord was not clamped until complete cessation of all pulsation and this was frequently, if not usually, after the delivery of the placenta.

TABLE III. IMMEDIATE AND DELAYED CLAMPING OF THE CORD

	IMMEDIATE CLAMPING		CLAMPING AFTER CESSATION OF PULSATION		
	NO. OF PATIENTS	HEMOGLOBIN	NO. OF PATIENTS	HEMOGLOBIN	ADVANTAGE
First day	103	18.14 Gm. Low 13.75 Gm. High 22.00 Gm.	77	19.03 Gm. Low 13.70 Gm. High 24.10 Gm.	+ 0.89 Gm.
Third day	95	17.59 Gm. Low 12.35 Gm. High 21.31 Gm.	61	18.51 Gm. Low 14.25 Gm. High 21.93 Gm.	+ 0.92 Gm.
Fifth day	51	17.35 Gm. Low 13.25 Gm. High 20.20 Gm.	20	17.63 Gm. Low 12.80 Gm. High 20.18 Gm.	+ 0.28 Gm.

Results

In Table I the total number of examinations made seems sufficient to rule out chance or coincidental findings. In the low and high hemoglobin brackets the number of patients is small as is to be expected in a spread extending from the two extremes of a group. The 1,552 prenatal hemoglobin determinations are the total number taken on the 176 patients during their office visits. The subdivisions chosen were on the basis of the average of the determinations made on each patient. This average was obtained, not as an example of a particular person's blood level, but rather as an indication of the over-all anemia or lack of anemia during the course of the pregnancy. It was felt that any single hemoglobin determination would not reflect the picture as it should be presented. By the same token it was believed that the average hemoglobin level in the newborn for the first, third, and fifth days best reflects the picture as a whole and that this number (398) is also sufficient to minimize chance and coincidence.

The findings in Table II indicate that there is no relationship between maternal prenatal hemoglobin and the hemoglobin of the newborn infant. As may be seen, the highest levels obtained in the newborn were those of babies of mothers who had the lowest hemoglobin levels. The lowest hemoglobin level found in

the newborn was that on the fifth day in babies born of mothers with the highest prenatal hemoglobin level. The general picture together with the minimum and maximum readings shows sufficiently small variation to lead one to believe that these variations are not significant. In Group I there were eleven mothers and twelve babies, one set of twins. The same was true of Groups II and III. Twins and prematurity did not seem to make any material difference. In this series there were no fetal deaths.

The immediate or delayed clamping of the cord at delivery has been reported to have an effect on the blood of the newborn. A study of this type should include allowances for this factor. As is shown in Table III in 103 deliveries the cord was clamped immediately. In 77 deliveries the cord was clamped after cessation of pulsation. Pulsations continued in some cases for as long as 15 to 20 minutes. The placenta was usually delivered as soon as it was ready and placed on the table with the baby until the pulsation should cease. The placenta was on the same level as the baby and no attempt was made to drain its blood into the fetal circulation or to strip the cord. As may be seen, the average hemoglobin level in the babies with delayed clamping was slightly higher than in those with immediate clamping. On the first day there was an average of 0.89 Gm. more hemoglobin in those with delayed clamping. On the third day there was an advantage of 0.92 Gm., and on the fifth day of 0.28 Gm. The spread of minimum and maximum readings, however, was about the same. It was felt that there probably is some advantage to delayed clamping of the cord but that this is not evident immediately after birth.

Summary

In summary, the findings in this series indicate that there is no relationship between maternal prenatal and newborn infant hemoglobin levels. There is probably some advantage to be found in delayed clamping of the cord but this was not evident in these babies immediately after delivery with hemoglobin obtained by heel puncture.

Conclusion

In conclusion we would like to suggest that more investigation by obstetricians of the relationship of the physiology of the mother and of her infant should be made. A large proportion of the contributions made in this field have been by pediatricians and physiologists. The responsibility of the obstetrician cannot end with the mother. A continuing interest in the maladies of her baby and their relationship to her prenatal course appear to be a logical part of the science of obstetrics.

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Discussion

DR. RICHARD L. PEARSE, Durham, N. C.—Drs. Parish and Brame have well demonstrated that any clinician with honest powers of observation and a notebook can produce a creditable piece of research.

The longer the reflection on the paper, the more interesting are the implications. In spite of all the notable variations of the human maternal diet, which runs the gamut from fish, fat, and raw meat to almost exclusively rice, the fetus is born with an adequate amount of hemoglobin. Whether Bantu or Lapp, all human babies, not erythroblastotic, have a polycythemia and a hemoglobin of well over 16 Gm.

We have delivered twice the wife of a visiting Hindu professor at Duke. Her religion forbids her to eat any animal proteins including, I believe, eggs and milk. In spite of an exclusively vegetable diet, not only did her two sons have normal hemoglobin readings, but the patient herself throughout her pregnancies maintained a higher hemoglobin level than did her beef-eating sisters.

Dutch and German women whose diets during the war consisted of as little as 600 calories a day produced healthy, well-nourished babies with normal hemoglobin content. It has been noted that while these women were on these restricted diets, toxemia and eclampsia almost disappeared. Obviously, the parasitic fetus can secure adequate supplies for the manufacture of blood regardless of the quality or quantity of the maternal diet.

In regard to the interesting observation of the authors that the babies who had the highest hemoglobin readings at birth were the progeny of the most anemic mothers, we must remember that the fetus is like an adult exposed to the anoxia of high altitudes. In adapting to such anoxia, adults have contraction of the spleen as an emergency measure, then as time passes they develop a polycythemia. The fetus is like a mountain climber and perpetually exposed to anoxia during intrauterine life. The blood in the maternal sinuses has a considerably lower oxygen tension than that in the maternal aorta. The fetal circulation is a mixed circulation and the blood in the umbilical vein at no time approaches the oxygen tension of adult arterial blood. Thus the fetal polycythemia is a mechanism to compensate for chronic anoxia. The higher hemoglobin values of the blood of infants of anemic women are, I am sure, a significant protective mechanism. It was Bancroft, I believe, who noticed higher hemoglobin values in the fetuses of goats and sheep that had been bled for experimental purposes to produce anemia.

DR. CHARLES B. CUNNINGHAM, St. Petersburg, Fla.—Dr. Brame has brought forth three points. Her studies show that the maternal hemoglobin level has no effect on the infant hemoglobin level. This confirms the work of previous writers. In review of two hundred cases at the Florence Crittenton Home in St. Petersburg we could find no evidence to the contrary. Eastman has stated that the serum calcium level of newborn infants was not altered even in the face of severe osteomalacia. It would appear that the child is a complete parasite.

Concerning the fact that supplementary iron preparations did not increase the maternal hemoglobin is not surprising. These preparations are not easily assimilated, especially when taken with meals, as they often are. However, it is sacrilegious today not to prescribe these preparations.

The distressing fact today is that by the use of these preparations emphasis is taken from the natural sources of these minerals and these are easily assimilated and utilized by the maternal organism.

Dr. Brame's results on delayed ligation of the cord show an increase in the fetal hemoglobin levels over those of the controls. The increase, however, is not quite as great as other observers have reported. It may be that stripping and gravity are necessary adjuncts in getting the blood into the fetal circulation.

OVARIAN CYST COMPLICATING PREGNANCY*

W. H. Grimes, Jr., M.D., R. A. Bartholomew, M.D., E. D. Colvin, M.D., J. S. Fish, M.D., and W. M. Lester, M.D., Atlanta, Ga.

(From the Department of Obstetrics and Gynecology, Emory University Medical School, and the Department of Obstetrics and Gynecology, Georgia Baptist Hospital)

THE recent occurrence of a twisted ovarian cyst complicating pregnancy prompted us to undertake a review of all pregnancies seen by two of us (R. A. B. and E. D. C.) prior to and since establishment of group practice of obstetrics.

Material

Of 19,740 consecutive records reviewed (1918 to 1953, inclusive), 4,669 were rejected because (1) the patient was transient or seen only in consultation; (2) the patient failed to return six weeks post partum for a final examination; (3) the cyst was of the lutein variety, associated with hydatidiform mole; or (4) the patient was eventually found not to be pregnant. Among the remaining 15,071 pregnancies, 185 were found to be complicated by cystic enlargement of one or both overies (Table I).

Table I. Incidence of Ovarian Cysts in Pregnancy

MATERIAL FOR STUDY	
Consecutive records reviewed	19,740 (1918 to 1953, inclusive)
Records excluded	4,669
Records remaining for study	15,071
Incidence of cysts	185 or 1:81

Frequency

Cystic enlargement of any degree, even though functional, must be included because of the possibility of further enlargement during pregnancy. This represents an incidence of 1 to 81, or 1.2 per cent, which is higher than that found by other authors. If the cyst was of such size as to constitute a definite hazard in pregnancy, the frequency was much less, 1 to 328.

Diagnosis

Diagnosis of ovarian cyst in pregnancy is greatly facilitated if the patient comes for examination in the first trimester. At this stage the cyst is still in the pelvis and is more easily palpated as to its size, shape, consistency, movability, and tenderness.

The stage of pregnancy at which ovarian cysts were diagnosed (185 cases) is clearly shown in Table II which indicates that 145, or 78 per cent, were discovered in the first trimester. Beyond this stage the cyst is usually drawn up by the enlarging uterus and diagnosis becomes much more difficult. Following delivery and involution of the uterus the cyst becomes increasingly palpable.

*Presented at the Sixteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Hollywood Beach, Florida, Jan. 14, 15, and 16, 1954.

Occasionally, by reason of its size the cyst is unable to rise with the uterus as pregnancy advances or is incarcerated or fixed by adhesions in the pelvis and thus is easily diagnosed at all stages of pregnancy.

TABLE II. STAGE OF PREGNANCY AT WHICH OVARIAN CYSTS WERE DIAGNOSED (185 CASES)

FIRST TRIMESTER	SECOND TRIMESTER	THIRD TRIMESTER	PUERPERIUM
145, or 78%	7, or 4%	4, or 2%	29, or 16%

The advance of pregnancy beyond the first trimester does not preclude the possibility of palpating a cyst alongside the body of the uterus. Seven cysts were thus diagnosed in the second trimester, three of which were removed in this period and four treated expectantly without complications. One of these, first diagnosed at four and still palpable at seven and one-half months beneath the rib margin, was found to have ruptured spontaneously prior to the time of cesarean section for eclampsia. The ruptured and collapsed cyst wall was demonstrable at the time of operation. Four cysts were first diagnosed in the third trimester. One of these disengaged itself from the pelvis in the eighth month, permitting normal delivery, and was removed seventeen months later. Two chanced to be found at the time of cesarean section and one was diagnosed as adherent in the pelvis at eight months and necessitated cesarean section at the time of removal.

Location

As seen in Table III the ovarian cyst was found to be unilateral in 95 per cent, bilateral in 4 per cent, and in the cul-de-sac in 1 per cent of cases. In the latter position it is occasionally difficult to determine whether the cyst arises from the right or left ovary. Of those occurring unilaterally nearly twice as many were found on the left as on the right. Haas[1] found the reverse to be true in his series.

TABLE III. LOCATION OF OVARIAN CYSTS IN PREGNANCY (185 CASES)

LOCATION	NUMBER
Unilateral	176, or 95%
Right	67, or 38%
Left	109, or 62%
Bilateral	7, or 4%
Cul-de-sac	2, or 1%

Management

If an ovarian cyst and pregnancy coexist, the complication most to be feared is torsion of the pedicle. Theoretically this is probably favored if the cyst is carried higher into the abdominal cavity as the uterus enlarges, where it may be more easily influenced by intestinal distention or bodily movements, especially if the cyst is irregular rather than round. The pedicle is probably able to resist torsion if the largest measurement of the cyst does not exceed 5 to 6 cm. It is therefore mainly on the basis of size that the management is operative or expectant. The consistency influences treatment to some extent, inas-

much as areas of firmness or a doughy consistency suggest cellular proliferation, or the presence of dermoid or teratoid growth, and favor operative treatment. Furthermore, roentgen-ray examination may confirm a dermoid or teratoid growth. Table IV indicates the number of cysts in each of these two groups.

TABLE IV. MANAGEMENT OF OVARIAN CYSTS FOUND IN PREGNANCY (185 CASES)

Nonoperative	139, or 75%
Operative	46, or 25%

Expectant treatment was considered preferable in 122 cases, or 87.8 per cent, of cysts which did not exceed 5 to 6 cm. (Table V). Operative treatment seemed indicated for 40, or 82 per cent of the cysts which did exceed 6 cm. As will also be seen from the table there was a total of 131, or 70 per cent of all cysts, irrespective of treatment, which were not larger than 5 to 6 cm., in contrast to a total of 55, or 29 per cent of cysts which were larger than 6 cm. The frequency of 1:81, previously stated as rather high in our series, is thus explained by the inclusion of cysts of 5 to 6 cm. or less.

TABLE V. SIZE OF CYST AS BASIS FOR OPERATIVE TREATMENT (185 CASES)

SIZE	OPERATIVE	NONOPERATIVE	TOTAL
Not exceeding 5-6 cm.	9, or 18%	122, or 87.8%	131, or 70%
Exceeding 6 cm.	40, or 82%	15, or 10.8%	55, or 29%
Not recorded	0	2, or 1.4%	2, or 1%
Bilateral cysts in operative group		3 cases	

Time of Removal

It appears that the ideal time to remove an ovarian cyst in pregnancy would be at a stage when (1) the possibility of a blighted ovum is no longer to be considered; (2) nausea and vomiting, if present, have thoroughly subsided; (3) the placenta has developed a sufficient production of progesterone; and (4) the size of the uterus neither requires undue manipulation nor adds difficulty to removal of the cyst.

Table VI indicates that these considerations influenced the stage of pregnancy at which the cyst was removed.

TABLE VI. STAGES OF PREGNANCY WHEN OVARIAN CYSTS WERE REMOVED (46 CASES)

STAGE OF PREGNANCY	NO. CYSTS REMOVED
First or second month	7
Third month	25
Fourth month	8
Fifth month	1
At term	4
In puerperium	1

It is noted that the majority of the cysts (25) were removed during the third month, the next largest number (16) were removed in the first and second and the fourth and fifth months (Table VI). As previously stated, a few cysts were not discovered and removed until cesarean section was performed at term.

As shown in Table II, 29 cysts were first discovered in the puerperium, 28 of these being treated expectantly as will be shown later. The remaining cyst was first diagnosed and removed two weeks following an unobserved but presumed abortion at two months. The preoperative diagnosis was ectopic pregnancy but at the time of operation an ovarian cyst was found.

Abortion Following Operation

There is much divergence of opinion relative to the importance of the luteal body in stabilizing and maintaining pregnancy in the first trimester. In recent years less importance has been attached to this supposed function of the luteal body. This opinion is apparently supported by numerous case reports of removal of an ovarian cyst with the luteal body at a very early stage of pregnancy without the occurrence of abortion.

Table VII indicates that the cyst was removed in 28 cases during the first trimester.

TABLE VII. INCIDENCE OF POSTOPERATIVE ABORTION IN CASES OF CORPUS LUTEUM REMOVAL

MONTH	NUMBER	CORPUS LUTEUM REMOVED	HORMONE TREATMENT	ABORTED
In first or second	7	4	2	0
In third	21	12	1	1
In fourth	8	4	0	0
In fifth	1	1	0	0
Total	37	21	3	1

In 16 of these the corpus luteum was removed together with the cyst. Only 3 of these patients received postoperative hormone therapy. One patient did not receive hormone therapy and aborted a fetus. In a total of 21 cases in which the corpus luteum was removed up to and including the fifth month only one abortion occurred (Table VII).

The discrepancy evident between the total of 37 cases shown in Table VII and the total of 46 cases shown in Table IV is explained by removal of the cyst at the time of cesarean section in 4 cases, after abortion in 1, and after therapeutic abortion in 4.

The indications for the therapeutic abortions in the third month were as follows: insanity (2); severe hypertensive disease (1); complicating cystic endometrioma (1). Obviously these could not be included in the cases operated upon in the third month.

The very low incidence of postoperative abortion in cases involving removal of the luteal body and without hormone therapy supports the belief that the presence of the luteal body is apparently not vital to the maintenance of the pregnancy.

Complications Attending Removal of Cyst

Complications attending removal of the ovarian cyst in pregnancy may be pre-existing or may occur at the time of removal.

It is noteworthy that 36, or 78 per cent, of the cases showed no complications (Table VIII).

TABLE VIII. COMPLICATIONS NOTED OR OCCURRING AT TIME OF REMOVAL OF OVARIAN CYST

COMPLICATIONS	NUMBER
None	36, or 78.27%
Extension of uterine incision	1, or 2.17%
Obstructing cyst	1, or 2.17%
Hemorrhage	1, or 2.17%
Inadvertent rupture	6, or 13.05%
Torsion of pedicle	1, or 2.17%
Total	46, or 100.00%

In one case extension of a low-segment cesarean incision into a previous Dührssen's incision necessitated a Porro operation. An obstructing incarcerated dermoid cyst necessitated delivery by cesarean section. In another case excessive hemorrhage complicated the removal of a cystic endometrioma associated with generalized pelvic endometriosis. In six cases the manipulations incident to delivering the cyst were attended by inadvertent rupture.

Although torsion of the pedicle is the complication most feared with ovarian cyst in pregnancy, in only one case did this accident occur. The patient registered at the sixth to seventh week of pregnancy at which time a left ovarian cyst was found which was estimated to be 10 cm. in size. She had previously noticed recurring attacks of pain in the left lower quadrant requiring sedation and also unexplained nausea and vomiting. It was planned to remove the cyst at about the third month but within twenty-four hours following a second pelvic examination at the tenth week, the pain, nausea, and vomiting became suddenly very severe, necessitating operation at once for probable twisting of the ovarian cyst. At operation the pedicle was found to be twisted two and one-half complete turns. The cyst, the ovary, the pedicle, and the overlying tube showed a bluish discoloration, but necrosis was not yet evident. There was amber-colored fluid free in the abdominal cavity. As soon as the torsion was relieved, the color of the structures returned at once to normal and the cyst, measuring 10 cm., was resected, leaving one-half the ovary in good condition. The patient made an uneventful convalescence, no hormone therapy being employed. At this writing the pregnancy is six months advanced and is progressing normally.

Pathology of Ovarian Cysts

As seen in Table IX a pathological diagnosis was obtained in 44, or 96 per cent, of the specimens removed.

TABLE IX. PATHOLOGY OF OVARIAN CYSTS REMOVED DURING PREGNANCY; 44, OR 96 PER CENT, DIAGNOSED BY PATHOLOGISTS

Teratoma 4; dermoid 7	11, or 22.5%
Follicular 10; with hemorrhage 4	14, or 29.0%
Corpus luteum cyst 11; with hemorrhage 1	12, or 24.5%
Cystadenoma, serous 2; pseudomucinous 3	5, or 10.0%
Endometrial cyst	1, or 2.0%
Fibroma with old hemorrhage	1, or 2.0%
Parovarian	2, or 4.0%
Unclassified	3, or 6.0%
Total	49, or 100.0%
Ovarian cyst bilateral in 3 cases	

The frequency of the various types of ovarian cysts obtained in this series is at variance, in some respects, from that cited by other authors and a true picture of the frequency could better be obtained by compilation of the results of many large series of cases.

Postoperative Disturbance to Pregnancy

It is stated by Patton[2] that interruption of pregnancy complicated by ovarian cyst occurs with about equal frequency whether the treatment is expectant or operative.

It is seen from Table X that, among 46 cases in which the cyst was removed, delivery occurred at term in 36, or 78 per cent, premature delivery in 3, or 7 per cent, and abortion in 6, or 13 per cent. Making correction for abortions which were therapeutic (4) and preoperative (1), the frequency is reduced to 1, or 2.5 per cent. Intrauterine fetal death occurred at term in one case in which there was severe hypertensive disease complicating the pregnancy.

TABLE X. PROGNOSIS OF PREGNANCY IN 46 CASES OF REMOVAL OF OVARIAN CYST

DURATION OF PREGNANCY	NUMBER	FETAL DEATH
Term	**36, or 78%**	**1, or 3%** (macerated stillborn infant)
Premature	3, or 7%	0
Abortion	6, or 13%	
Therapeutic	4,	
Preoperative	1,	
Postoperative	1,	
Undelivered	1, or 2%	
Mortality among viable fetuses, corrected		0
Incidence of postoperative abortion		2.5%

From these results it does not seem that removal of the cyst has any adverse effect as to interruption of the pregnancy.

Behavior of Cyst—Nonoperative Group

As has been previously stated, the expectant treatment is theoretically preferable if the cyst is not over 5 to 6 cm. in size. Justification of the policy may be seen in Table XI.

TABLE XI. PERSISTENCE OF OVARIAN CYST DURING OR AFTER PREGNANCY. NONOPERATIVE GROUP (139 CASES)

	NUMBER	PERSISTING IN PUERPERIUM	POSTPUERPERAL	
			FOLLOW-UP	PERSISTING
Cyst first diagnosed in pregnancy	111, or 80%	11, or 13.5%	6	4
5 to 6 cm.	98	6, or 6%	4	2
6 + cm.	13	5, or 39%	2	2
Cyst first diagnosed in puerperium	28, or 20%		16	2
5 to 6 cm.	23, or 82%		11	1
6 + cm.	5		5	1
Ovarian cyst present during pregnancy but not found postpartum				86.5%

Among 111 ovarian cysts first diagnosed in pregnancy, only 11, or 13.5 per cent, were still present on examination in the postpartum period. Since 100 disappeared during pregnancy it would naturally be assumed that this would be true only of the small cysts, and this is confirmed by the analysis which shows that 98 were not more than 5 to 6 cm. in size. It may well be concluded, therefore, that the small cysts were functional in type. However 6, or 6 per cent of the small sized ones, did persist in the puerperium; four of these were further followed in the postpuerperal period and 2 were still present.

As to the 13 larger cysts first diagnosed in pregnancy, 5, or 39 per cent, were still present in the puerperium, which is more than 6 times the persistence rate of the smaller cysts. Two of the larger cysts which persisted in the puerperium were followed postpuerperally and were still present.

Among 28 cysts first diagnosed in the puerperium, 23, or 82 per cent, were not over 5 to 6 cm. in size. Eleven patients in this group returned for examination in the postpuerperal period and in only one patient was the cyst still present. All 5 patients in whom the cyst was more than 6 cm. in size returned for postpuerperal examination and in only one was the cyst still present. This emphasizes that the policy of watchful waiting for a certain period is as valuable in the postpuerperal period as under other conditions, provided the tumor is cystic in character. If the cyst persists or increases in size or shows areas of firmness, a neoplastic growth must be considered.

As shown in Table XII ovarian cysts give rise to very few complications during pregnancy, 78, or 56.1 per cent, being uncomplicated.

TABLE XII. COMPLICATIONS NOTED IN NONOPERATIVE OVARIAN CYSTS IN PREGNANCY (139 CASES)

COMPLICATIONS	NUMBER
None	78, or 56.1%
Bleeding in pregnancy	54, or 38.9%
Spontaneous rupture	1, or 0.7%
Rupture with examination	6, or 4.3%
Total	139, or 100.0%

Threatened abortion, abortion, and bleeding in late pregnancy occurred in 54, or 38.9 per cent—a frequency very little greater than that quoted in a recent analysis of bleeding in pregnancy.[3] Rupture during examination occurred in 6, or 4.3 per cent, but was followed by no serious consequences. Reference has already been made to the spontaneous rupture of a cyst late in pregnancy as verified at cesarean section for eclampsia at term.

As seen in Table XIII the prognosis for the fetus appears somewhat less favorable from the fact that abortion occurred in 20, or 14.4 per cent. Neonatal death occurred in 2 cases, or 1.7 per cent.

Although abortion occurred in 20 cases, or 14.4 per cent, 12 of these were blighted or afetic products and missed abortions; 2 were therapeutic abortions (for severe hypertensive vascular disease, and severe hyperemesis). In 6 cases the cause of the abortion could not be demonstrated. On the basis of this correction the frequency of abortion was 4.3 per cent, indicating no adverse effect.

There was no maternal mortality in either the nonoperative or the operative groups.

TABLE XIII. PROGNOSIS OF PREGNANCY IN 139 NONOPERATIVE CASES OF OVARIAN CYSTS IN PREGNANCY

	NUMBER	NEONATAL DEATH
Term	110, or 79.00%	2, or 1.70%
Premature	5, or 3.60%	
Abortion*	20, or 14.40%	
Undelivered	4, or 3.00%	

*Abortions (blighted ovum, afetic, missed) 12; therapeutic 2; cause unknown 6.

Comment

The frequency of ovarian cysts complicating pregnancy, in the literature which was reviewed, varied from 1:102[4] to 1:2,500.[5] Considering the fact that "number" is concerned with "size," only two authors,[1, 5] specifically mentioned size of the cysts. Presumably those which are functional are not larger than 5 to 6 cm., when discovered in the first trimester. They apparently do not increase in size during pregnancy and have usually disappeared when final examination is made in the puerperium (Table XI). Hospital statistics must obviously be misleading since emergencies created by ovarian cysts during pregnancy must disproportionately increase the number of these cases. Statistics from private practice furnish the most dependable basis for estimating the frequency of this complication, provided records are conscientiously kept and indexed, and include not only the period of pregnancy but also the puerperium.

If one compares the gravity of ovarian cysts complicating pregnancy, as described by authors in the early part of the present century, with the striking reduction in such complications, as demonstrated by recent authors, he must give full credit to the development of prenatal care, which brings the patient to her physician at an early stage of pregnancy when diagnosis and definitive care can be easily and more safely accomplished.

McKerron of Aberdeen, quoted by Wilson,[6] published a report of 720 cases in 1906. The maternal mortality was 21 per cent. Patton,[2] in 1906, collected 321 cases from the literature; 95 were treated expectantly, but complications such as hemorrhage into the cysts, suppuration, twisted pedicle, and peritonitis caused 25 deaths, or a mortality of 26 per cent. Operative treatment was employed in 184 cases and resulted in 8 maternal deaths, or a mortality of 4.5 per cent. Six of these deaths were due to sepsis. Wilson,[6] in 1937, reported 30 cases, in 28 of which operative treatment was employed, with no maternal mortality. Haas,[1] in 1939, reported 25 cases, in 16 of which operative treatment was employed, and mentioned no maternal death.

Since symptoms due to ovarian cyst are negligible during pregnancy, diagnosis later than the first trimester becomes difficult unless the cyst reveals its presence by serious complications.

If examination in the first trimester reveals a movable ovarian cyst not more than 5 to 6 cm. in size, and shows no areas of firmness, it may be treated expectantly. In this series, the absence of complications during pregnancy and failure to demonstrate the cyst in the puerperium justify this policy.

If examination early in pregnancy reveals a cyst exceeding 6 cm. in size, the potential hazards justify elective removal of the tumor early in the fourth month. Operation at this stage presents certain advantages, namely, (1) nausea and vomiting, if previously present, have probably disappeared and the incision will not be strained, (2) blighted products of pregnancy, if present, will have been demonstrated and justify further observation of the cyst, (3) the theoretical stabilizing function of the luteal body will have been utilized and taken over by the placenta, (4) stretching of the abdominal incision is postponed and minimized, and (5) manipulations of the uterus consequent to removal of the cyst are lessened.

Opinion as to the need of preserving the luteal body in the first trimester of pregnancy is about equally divided, pro and con. Wilson's[6] results are unfavorable (100 per cent); Caverly's[7] are quite favorable (83 per cent); Ask-Upmark's, quoted by Pratt[8]—reporting 51 cases in which the corpus luteum was removed in the first two months—were only slightly more favorable than unfavorable (66 per cent) and Pratt[8] reported 2 cases in which removal of the corpus luteum 30 and 21 days, respectively, following the last menstrual period, was 100 per cent favorable, in that pregnancy progressed to term in each case. Our own results (Table VII) apparently indicate that the luteal body is not essential to preservation of the pregnancy and that prophylactic postoperative hormone therapy is likewise not essential.

We cannot agree with Litzenberg,[9] Capone,[10] and Caverly[7] that removal of a cyst complicating pregnancy is mandatory, with very rare exceptions, regardless of size, location, or type. Also, the mere fact that delivery immediately preceded discovery of the cyst, should not necessarily justify immediate removal. A further period of observation, as shown in Table XI, indicates that ovarian cysts, even of larger size but of uniform cystic consistency, usually disappear spontaneously.

Patton,[2] in an analysis of 331 cysts complicating pregnancy, found that abortion occurred with equal frequency (19 per cent) whether the cysts were treated expectantly or were removed. In our own series, the abortion rate, uncorrected, was 13 per cent in cases of removal, but when corrected for reasons previously explained the incidence was reduced to 2.5 per cent (Table X). Among those treated expectantly, abortion occurred in 14.4 per cent, but when corrected for reasons explained in Table XIII, the frequency was 4.3 per cent. It is noteworthy that, in the references consulted, no description of the products of abortion was given, thus inferring that the cyst was the probable etiological factor. It is doubtful that abortion due to embryological defects of the conceptus could be related to the presence of an ovarian cyst. In a recent unpublished analysis of 3,694 consecutive pregnancies in our group practice, abortion occurred in 203 cases, or 5.5 per cent—a frequency approximately the same as that previously mentioned in connection with ovarian cysts treated expectantly.

Having noted in a previous study[3] an incidence of bleeding in pregnancy of 33.2 per cent, it is of interest to note that in this much smaller series bleeding occurred in 38.9 per cent (Table XII) in association with ovarian cysts.

As to ovarian cysts which escape detection in the first trimester and may or may not be found in the second and third trimesters, expectant treatment is usually followed, subject to occurrence of complications which may necessitate immediate removal.

Patton[2] reported 31 cases treated by tapping when surgery was refused; 12 of these patients died—a mortality of 38 per cent. Haas[1] suggests aspiration by way of the cul-de-sac, if the cyst is thin walled and blocking descent in labor, to be followed by removal after delivery.

Conclusions

1. Based on the records of 15,071 consecutive pregnant women, seen throughout pregnancy and the puerperium in private practice, some degree of cystic enlargement of an ovary was found in 1 of 81 pregnancies; enlargement of more than 6 cm. was found in 1 of 274 pregnancies.

2. Diagnosis and prognosis are greatly facilitated and benefited if prenatal care is instituted early in the first trimester.

3. Ovarian cysts not more than 5 to 6 cm. in size, freely movable and showing no areas of significant firmness, may be treated expectantly and will usually have disappeared by the end of the puerperium.

4. Ovarian cysts more than 6 cm. in size should be removed on account of the potential dangers of torsion of the pedicle, hemorrhage, gangrene, and infection.

5. The optimum time for removal is early in the fourth month. If not discovered until the puerperium, a period of observation is justified, during which time the cyst often decreases or disappears.

6. The incidence of abortion, whether treatment is expectant or operative, is apparently not increased.

7. Removal of the corpus luteum apparently does not increase the incidence of abortion, even when performed very early in pregnancy.

8. Prophylactic postoperative hormone therapy is apparently not indicated or essential.

9. There were no maternal deaths. Fetal mortality was not increased.

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Discussion

DR. JOHN R. KERNODLE, Burlington, N. C.—This report of 185 ovarian cysts complicating pregnancy constitutes the largest number of such cases reported in the last 45 years, the largest group on record being that of the 720 cases of McKerron in 1906.

In the literature from 1900 to 1930 all authors recommended immediate surgery when the diagnosis of ovarian cyst complicating pregnancy was made. These early reports likewise showed a maternal mortality of 16 to 26 per cent. The most recent reports show a mortality of zero, and this is followed through in the report heard this morning.

In this series of patients, the management has been primarily conservative, with observation of all cysts less than 5 to 6 cm. in size, unless the diagnosis was made of a neoplastic growth by roentgen studies or clinical examination. The majority of the patients who had a tumor greater than 6 cm. continued to have the tumor after the gestation, and operation was necessitated post partum.

The abortion rate following operation has been extremely low, and is parallel with that given in the most recent literature in which several authors have stated that complete removal of the ovaries, including the corpus luteum, has no effect on the continuation of pregnancy. Dr. Grimes' series bore this out in that there was only one abortion. The classification of these cysts revealed that 25 per cent of the total number removed were corpora lutea and the majority of these were removed in the third month of gestation. These two facts will be commented on a little later.

During the first few months of private practice, two patients were referred to us within ten days' time with small ovarian cysts associated with pregnancy in the first trimester. We recommended conservative observation in these individuals, but the local general practitioner and the patients were slightly dissatisfied; therefore, they were referred to a general surgeon who operated immediately. Both patients aborted within three days after the operation, and at the time of operation luteal cysts were removed. Because of this, we have been very conservative in our treatment of ovarian cysts complicating pregnancy.

During the last two and one-half years our group has encountered 14 ovarian cysts associated with 925 obstetrical deliveries. Of this number only two received immediate operation. Both were thought to be associated with torsion of the pedicle. One was first diagnosed at three and one-half months of pregnancy, and when the abdominal cavity was entered a corpus luteum cyst about 6 cm. in size was encountered. There was one twist in the pedicle. This twist was released and the cyst aspirated. Appendectomy was performed, and the patient continued through the remainder of her gestation without further discomfort, delivering spontaneously five and one-half months later a living child. Puerperal follow-up revealed no evidence of recurrence of the cyst. The second patient was first seen at seven and one-half months of pregnancy with possible appendicitis. Operation was performed with removal of a right dermoid cyst measuring 8 cm. in diameter, markedly gangrenous because of three twists in the pedicle. A third patient was operated upon during pregnancy, but only after observation for two months. She was first seen in the second month of pregnancy and was followed with a 15 to 18 cm. boggy cystic mass, thought to be a dermoid. At the time of operation, performed at four and one-half months, a large dermoid cyst was removed with little difficulty. Postoperatively she has had no trouble and is now seven and one-half months pregnant. The remainder of the patients with ovarian cysts were followed throughout gestation, delivery, and at the time of their six weeks post partum examination only two were still noted. One, a 5 to 6 cm. dermoid cyst, was resected five and one-half months after delivery without complication; the second, a 7 to 8 cm. papillary cystadenoma of the ovary was resected six months post partum.

We agree wholeheartedly with all of the conclusions except that which recommends that all cysts over 6 cm. in size should be removed. I wonder if some of the luteal cysts which were removed in the third month of gestation would not have regressed and disappeared had they been followed through four and one-half months of pregnancy. I am sure from my own experience that some much larger than that have disappeared. One illustration is the case of a gravida ii, who had an ovarian cyst associated with her first pregnancy 7 years ago. Following delivery the cyst disappeared completely, and during the interim she had annual checkups without evidence of ovarian cyst. Recently she was seen by our group in the second month of pregnancy with an ovarian cyst measuring approximately 13 cm. in size. Again because of our previous ruling that we would wait until four and one-half months before any

operative intervention, this patient was observed with careful instructions as to pain or discomfort. At four and one-half months of pregnancy the cyst had decreased in size and now at six months measures only approximately 5 to 6 cm. in diameter. I think this cyst will regress completely by the time she has her postpartum checkup. Certainly, I can see no disadvantage to waiting through gestation as long as you have close contact with your patients and can offer immediate emergency care. I believe the dangers are minimal, and in view of present-day operative techniques and antibiotic therapy immediate operation may be deferred unless the clinical course necessitates intervention.

DR. W. A. HART, Columbia, S. C.—During the twenty years that I have practiced obstetrics only I have seen just four cases of ovarian cyst complicating pregnancy. All were unilateral, two on the left side and two on the right. The first patient was two months pregnant and the cyst was removed at the third month and the patient delivered premature living twins at seven and one-half months. The second patient was about three months pregnant and the cyst was removed at four months, and she delivered normally five months later. The third patient was two months pregnant and the cyst ruptured on bimanual examination in my office. No ill effects resulted. The fourth case was diagnosed at about two and one-half months' pregnancy, but the patient moved out of the state shortly afterward and the last I heard of her was that her progress was satisfactory. She was then five months pregnant.

The teaching of the importance of prenatal care during the past twenty-five years has resulted in more women coming to the obstetrician at an earlier date and therefore the diagnosis can be made more easily. Dr. Grimes showed us in his series that 145 cases, or 78 per cent, were diagnosed in the first trimester. By being able to make this early diagnosis we are better prepared to decide on the proper procedure in the individual case. On reviewing the literature on the subject for the past several years I found that most of the authors agree with Dr. Grimes in his recommendations as to the proper care of these patients. The treatment has become more conservative through the years, which of course results from our experience with more cases and the early diagnosis.

Dr. Grimes' conclusions that early in the fourth month is the optimum time to operate and that hormone therapy is apparently not indicated are quite different from what we were formerly taught, but now we all agree with them.

CESAREAN SECTION IN AN OPEN STAFF GENERAL HOSPITAL*

A Five-Year Study

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MANY factors have entered into the improved picture of American obstetrics over the past two decades: antibiotics and chemotherapeutic drugs, increased availability of blood transfusions, better analgesic and anesthetic agents and techniques, increasing utilization of improved hospital facilities, and augmented teaching and resident training programs. All of these have contributed to the change in concept of the place of abdominal delivery in a management of the patient, but there is apparently a wide individual variation in that concept if one takes the incidence of the utilization of cesarean section as an index.

Eastman[1] estimates that about 2 per cent of all American women are delivered by abdominal section. This over-all figure is difficult to arrive at, but the figures from the obstetric services of the better-organized hospitals speak for themselves (Table I).[2] Current statistics indicate a variation from 0.65 to 9.7 per cent. The obstetric picture at some of these institutions represents a concentration of specialists with many referred problem cases, at others the dominating ideas of a single individual are reflected, while yet others are heavily weighted with the extensive pathology of the indigent patient. The Crawford W. Long Memorial Hospital is an open staff general hospital averaging more than 5,000 deliveries per year. No single obstetrician or group delivers as many as 10 per cent of the patients, and general practitioners manage almost half of them. A study of cesarean section in such an institution should give a fairly typical cross section of obstetric practice except that the patients are almost entirely of the white race.

Abdominal delivery is apparently utilized most extensively on the West Coast and least in the South. Nearly all reports show the private patient to be delivered more often through the abdomen than the charity or ward patient, although the latter undoubtedly furnishes more than her proportionate share of obstetrical difficulties. The three hospitals with the lowest cesarean section rates in Table I are "all charity" institutions, two of them in the deep South and one "on the border." The time involved was not synchronous for all of the hospitals, but no periods were of less than five years. The mortality rate of the various hospitals is remarkably low by previous standards, but

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definitely varies from lowest in a large service with a relatively wide utilization of section to highest in the all-charity institutions seldom resorting to abdominal delivery, and then presumably for their worst problems only. Perhaps this variation in mortality rate is not due so much to surgical technique as to selection of patients and other factors.

TABLE I. CESAREAN SECTION INCIDENCE AND MORTALITY

HOSPITAL	INCIDENCE (%)	MORTALITY (%)
Good Samaritan, Los Angeles	9.7	
Cedars of Lebanon, Los Angeles	9.7	0.05
Millard Fillmore, Buffalo	8.16	0.22
Kansas City Hospitals	7.1	
University of Pennsylvania	7.0	0.35
Cleveland Maternity	6.1	0.62
Jewish, of Brooklyn	5.5	0.66
Margaret Hague Maternity	4.09	0.17
Johns Hopkins	4.8	0.21
Chicago Lying-in	4.3	0.32
Boston Lying-in	3.5	0.57
Crawford W. Long Memorial	2.09	0.18
Duke University	1.8	0.69
Atlanta Hospitals	1.57	
Jefferson Davis, Houston	1.03	0.87
Cincinnati General	1.0	1.1
Grady Memorial, Atlanta	0.65	1.59

TABLE II. CESAREAN SECTIONS, ATLANTA HOSPITALS, 1948-1952

	DELIVERIES	SECTIONS	INCIDENCE (%)
Hospital "A"	6,742	232	3.45
Hospital "B"	4,222	98	2.7
Crawford W. Long Memorial	26,954	563	2.09
Hospital "D"	8,625	198	1.7
Hospital "E"	6,529	98	1.35
Hospital "F"	27,979	199	0.65
All Atlanta Hospitals	81,051	1,388	1.62
Private Atlanta Hospitals	53,072	1,125	2.16
Charity Atlanta Hospitals	27,979	189	0.65

Table II shows a comparison of cesarean section in the hospitals of Atlanta. Despite a nationwide tendency toward increasing use of this type of delivery, not a single Atlanta hospital showed increasing incidence of the operation during the five-year period, and most of them actually showed a decrease. Especially significant decreases took place in two of these institutions. In one it coincided with the changed practice of a single physician and in the other it followed increased utilization of the hospital's facilities by specialists instead of general practitioners. As expected, the lowest cesarean section incidence in Atlanta was in the all-charity services, but the next lowest hospital had no charity obstetric service at all. The Crawford W. Long Memorial Hospital, with more deliveries than all the other Atlanta private hospitals combined, occupied a median position. About 10 per cent of our deliveries were in service patients, but this group is unique in that a rather high proportion are wives of college students and service men in whom the economic pinch is temporary. Obviously they do not present the usual problem of in-

digent patients. The cesarean section rate was so extremely low in Atlanta's only "all charity" hospital that the review of its experience, promised in the near future, will be looked for with interest.

The number of deliveries in the Crawford W. Long Memorial Hospital showed slight annual fluctuation over the five-year period and the incidence of abdominal delivery likewise varied little, although it was lowest for the last year of study (Table III). The five-year incidence of 2.09 per cent will, perhaps, be as puzzling to the obstetricians who utilize cesarean section in almost a tenth of their patients as their apparent need for this method of delivery is to us.

TABLE III. CRAWFORD W. LONG MEMORIAL HOSPITAL

	DELIVERIES	SECTIONS	INCIDENCE (%)
1948	5,157	102	1.78
1949	5,436	119	2.14
1950	5,339	138	2.58
1951	5,561	119	2.05
1952	5,461	85	1.56
Five-year period	26,954	573	2.09
Midforceps deliveries		848	3.15
Dührssen incisions		10	0.04
Failed forceps		5	0.02

The indications for cesarean delivery are listed in Table IV. Often multiple indications were given in the case record but an effort was made to evaluate the principal reason for the operation and to list it as such in the statistics. With few exceptions, our attendants make a practice of repeating cesarean delivery regardless of the indications for the initial operation, and all "repeat sections" are so listed unless the operation was necessitated by uterine rupture or threatened rupture. As usual, previous cesarean section, cephalopelvic disproportion, and hemorrhage were the three leading indications for abdominal delivery. Disproportion could not be accurately evaluated as to fetal and maternal origin despite some attempts to do so appearing virtually in all the case records. Relative pelvic contracture was not always substantiated by the data available. Absolute contraction is very rare in the Southern white woman and occurred only twice in this series, both in chondrodystrophic dwarfism. Toxemia ranked very low among the indications and the operation was virtually always performed after failure of either medical management or attempts at induction of labor, or both. The influence of Dr. James R. McCord on his pupils is reflected here despite their greater resort to cesarean section.

One is inclined to philosophize on "sections done versus sections not done." In this particular series with relatively low incidence of cesarean section, one may wonder if the operation should not have been extended to some patients who might have needed it, but a careful study of some of the indications listed will show a number of patients who probably should not have received it ("for sterilization only," "psychosis," "double vagina," "uterus didelphys," etc.). The ten Dührssen incisions performed in the hospital over

the five-year period will be regarded by some as "cesarean sections that should have been," but with one exception they were in patients with low station and sufficient dilatation and effacement to be relatively bloodless, and delivery was accomplished easily. There were no maternal deaths and all babies were discharged in good condition. The number of midforceps deliveries, 848, may seem relatively high, but it is not due to the low incidence of cesarean section but to a rigid classification of forceps operations. For example, all conversions of position of the fetal head, regardless of station at the beginning of the procedure, are classified as midforceps.

TABLE IV. INDICATIONS FOR SECTION, CRAWFORD W. LONG HOSPITAL

	NO.	%
1. Previous cesarean section	211	37.4
2. Cephalopelvic disproportion	129	21.1
3. Placenta previa (central 37, others 21)	58	10.3
4. Dystocia (inertia 22, cervical 5, constriction ring 1)	28	4.9
5. Abnormal presentation or position	25	4.5
6. Toxemia (Eclampsia 1, pre-eclampsia 22)	23	4.0
7. Abruptio placentae	16	2.8
8. Elderly primigravida with sterility problem	10	1.7
9. Rupture of uterus (actual 8, suspected 2)	10	1.7
10. Tumor obstructing birth canal	9	1.6
11. Fibromyoma requiring surgery	8	1.5
12. Erythroblastosis, for fetal salvage	8	1.5
13. Prolapse of umbilical cord	8	1.5
14. Previous extensive vaginal plastic surgery	5	0.9
15. For sterilization of patient only	3	0.5
16. Previous difficult labor or delivery	2	0.4
17. Psychosis	2	0.4
18. Cervical carcinoma, double vagina, uterus didelphys, habitual antepartum loss of fetus, hypertensive vascular disease, previous myomectomy, previous serious hemorrhage from varices of upper vagina, previous Dührssen's incisions, each	1	0.2

We have no definition for "trial forceps" and it was included with "failed forceps" in the statistics. At least two cases should not be classed as failures: experienced obstetricians made no further effort at delivery from below after failure to secure favorable application, etc.

During the period of study ten maternal deaths occurred in the 26,386 vaginal deliveries in the hospital. Could abdominal delivery have saved any of these women? The causes of their deaths—(1) sepsis due to recurrent carcinoma of the alveolar ridge, (2) rupture of cerebral aneurysm, (3) eclampsia after poor prenatal care, (4) rupture of uterus with massive retroperitoneal hemorrhage after rapid spontaneous delivery in a multipara, (5) diabetic coma, (6) uremia from bilateral calculous pyonephrosis (spontaneous late abortion), (7) rheumatic heart disease with arteriolar nephrosclerosis (the patient admitted in failure), (8) postpartum hemorrhage due to atony in a spontaneously delivered multipara, (9) auto accident with transection of cord, multiple rib fractures, and other trauma, (10) chorioadenoma destruens after early spontaneous abortion—obviously answer for themselves. Do we have a callous attitude toward the breech baby in withholding abdominal delivery? During the period of study 750 patients with breech presentation were delivered.

There were no maternal deaths and the uncorrected total fetal loss of term babies was 23, or 3.5 per cent. Corrected for 10 babies dead on admission, two with anomalies incompatible with life, the loss of breech term babies was 11, or 1.48 per cent.

The age and parity of the patients receiving cesarean delivery need no comment (Table V).

TABLE V. AGE AND PARITY OF CESAREAN SECTION PATIENTS AT CRAWFORD W. LONG MEMORIAL HOSPITAL

AGE	NUMBER	PARA	NUMBER
Under 16	4	0	210
17-20	40	i	217
21-25	160	ii	82
26-30	156	iii	36
31-35	119	iv	9
36 and over	84	v or more	9

The types of operation performed and classification of operators are of some interest (Table VI). Slightly more than half of the deliveries at Crawford W. Long Memorial Hospital are conducted by specialists in obstetrics. Their use of abdominal delivery was about the same as that of other attendants, but they did virtually all of the low cervical and extraperitoneal operations while general practitioners and general surgeons used the classical operation. The morbidity of the two operations were essentially the same. The hospital rules require consultation in cases of cesarean section, but they seldom require enforcement by anything other than tactful suggestion. The success of this method is reflected in the low incidence of the operation at the institution.

TABLE VI

	NO.	%
Types of Cesarean Operation.—		
1. Low cervical (morbidity and complications 20.2%)	288	51.1
Transverse incision 262		
Longitudinal incision 26		
2. Classical (morbidity and complications 19.9%)	261	46.3
3. Cesarean hysterectomy	14	2.7
4. Extraperitoneal	1	0.2
5. Postmortem (not included otherwise)	1	0.2
Classification of Operators.—		
1. American Board of Obstetrics and Gynecology certified specialists	205	36.4
2. Other obstetricians	79	13.9
3. General practitioners and general surgeons	280	49.4

The choice of anesthesia for cesarean section shows a marked preference for conduction block methods (Table VII). The five-year tendency was strongly toward increasing use of these methods, especially small single-dose spinal anesthesia. Usually only 3 to 5 mg. of Pontocaine in heavy dextrose-Adrenalin solution was used. This was supplemented after delivery of the baby largely for psychic reasons and not because of limitations of the method. It is the distinct impression of most critical observers that the babies require less "resuscitation" under such management than under general anesthesia.

TABLE VII. ANESTHESIA FOR CESAREAN SECTION AT CRAWFORD W. LONG MEMORIAL HOSPITAL

	NO.	%	NO.	%
1. Conduction Block*			402	70.0
Spinal†	361	63.6		
Local infiltration	38	6.7		
Caudal	3	0.5		
2. General Anesthesia			163	30.0
Pentothal Sodium and cyclopropane	94	16.5		
Cyclopropane	38	6.7		
Pentothal Sodium	14	2.4		
Pentothal Sodium and nitrous oxide	6	1.1		
Ether	5	0.9		
Cyclopropane and nitrous oxide	3	0.5		
Cyclopropane and ether	1	0.2		
Cyclopropane, nitrous oxide, and Trilene	1	0.2		

*Commonly supplemented by light general anesthesia after delivery.
†Including 2 failures.

TABLE VIII. MORBIDITY AND COMPLICATIONS IN CESAREAN SECTION

Total cases morbidity		84	(14.8%)
Total cases morbidity and complications		123	(21.8%)
Undetermined cause	36	Wound infections	3
Urinary infections	28	Diarrhea	2
Adynamic ileus	11	Puerperal psychosis	2
Upper respiratory disease	8	Parametritis	1
Endometritis	7	Hematoma of bladder flap	1
Dehydration	6	Eclampsia, post partum	1
Postoperative hemorrhage	6	Pulmonary embolus	1
Postoperative shock	6	Thrombophlebitis, leg	1
Mastitis	4	Dehiscence of abdominal wound	1
Transfusion reaction	3	Malaria	1
Bronchial pneumonia	3		

In compiling morbidity statistics at our institution, we were struck by the fact that the accepted American Committee on Maternal Welfare yardstick, temperature of 100.4° F. on two or more successive days of the puerperium excluding the first day, does not reflect the jeopardy of the puerpera, either abdominally or vaginally delivered, at the present time. The tendency to give antibiotics to all patients who have complicated labors or difficult operative deliveries and to give them to all others once the temperature spikes masks complications by suppressing the febrile response. For example, the patients with thrombophlebitis and dehiscence of the abdominal wound with eventration of viscera were both afebrile but, obviously, were definitely sick. For this reason "morbidity and all significant complications" are listed together (Table VIII). A study of Table IX shows that supplementary surgery, especially extragenital, tends to increase morbidity. So also do anemia and prolonged labor, especially with prolonged rupture of the membranes, regardless of the use of antibiotics, however desirable this may be (Table X). The incidence of vesicle and bowel injury seems low for a heterogeneous group of operators.

The sole maternal death of this study ended a fortunate period of nearly 7,000 deliveries without a mortality.

A 29-year-old gravida i with history of eight years of sterile marriage was delivered by low cervical cesarean section after twelve hours of labor with breech presentation in a borderline pelvis. Her immediate postoperative course seemed satisfactory and she

was ambulatory and asymptomatic on the second day. On the third day she developed a temperature of 102° F. Examination revealed no apparent cause for this, but there was slight distention of the abdomen. She was placed on Aureomycin, 250 mg. orally every six hours. After twelve doses, diarrhea developed, which continued despite prompt omission of the drug, and rapidly progressed to an extreme degree. Repeated stool cultures were negative. The patient lost as much as 14,000 c.c. of liquid stool plus vomitus in a single twenty-four-hour period. She was unable to retain anything administered orally. Despite heroic efforts to maintain hydration and nutrition, death from electrolyte imbalance occurred on the tenth postoperative day. Autopsy disclosed only a generalized membranous gastroenterocolitis. Cultures again revealed no pathogens. The anatomical cause of death, Aureomycin sensitivity, was an ironic reminder that one of our most prized weapons was a two-edged sword and that this patient might have survived in a former day.

TABLE IX. OTHER SURGERY AT CESAREAN SECTION

OPERATION	NUMBER	MORBIDITY	
		NO.	%
1. Tubal sterilization	132	16	12.1
2. Cesarean hysterectomy	14	1	7.0
3. Myomectomy	7	0	0.0
4. Salpingo-oophorectomy	5	1	20.0
5. Oophorectomy	2	1	50.0
6. Lysis of adhesions	2	1	50.0
7. Partial oophorectomy	1	0	0.0
8. Salpingectomy	1	0	0.0
9. Appendectomy	1	1	100.0
10. Repair of umbilical hernia	1	0	0.0
All supplementary surgery	166	21	12.0

TABLE X. MISCELLANEOUS DATA

	NUMBER	%	MORBIDITY	
			NO.	%
Anemia (Hb. 10 Gm. or less at operation)	80	14.8	15	18.0
Transfused (before, during, or after)	282	49.6		
Prolonged labor (over 24 hours)	35	6.7	4	11.4
With membranes ruptured	31	5.4	4	12.0
With membranes intact	4	0.7	0	0.0
With prophylactic antibiotics	26	4.5	4	15.0
Membranes ruptured 12 hours or more (All received prophylactic antibiotics)	70	13.2	10	14.5
Patients with cephalopelvic disproportion who received x-ray pelvimetry	73	57.0		
Patients with cephalopelvic disproportion with trial labor of 8+ hours	86	67.5		
Bladder injuries (immediate repair)	3	0.5	0	0.0
Bowel injuries	0			

The fetal salvage in cesarean operation (Table XI) was relatively good. The total fetal loss for term babies, 2.4 per cent, is falsely reassuring if one does not consider the possible hazards to the fetus. Thirty, or 6.4 per cent, of all term babies delivered by cesarean section in this series were regarded, either by the obstetricians or by the Newborn Pediatric Service, as presenting definite and potentially serious resuscitation or other neonatal difficulties. A comparison of the maternal or fetal mortality from vaginal and abdominal delivery (Table XII) refutes the common idea that cesarean section is usually favorable to the fetus.

TABLE XI. FETAL SALVAGE IN CESAREAN SECTION

	NO.	%
I. Term babies (2,500 grams or over)	498	86.6
A. Stillbirths	4	0.8
Rupture of uterus 2, abruptio 1, undetermined 1		
B. Neonatal deaths	8	1.6
Adrenal cortex hypoplasia 1, respiratory problems 4, erythroblastosis 1, undetermined 2		
Note: 30 (6.4 per cent) of all term babies had resuscitation or other neonatal difficulties		
II. Premature babies (1,000 to 2,499 grams) (Includes 5 sets of twins)	71	13.4
A. Stillbirths	3	4.2
Rupture of uterus 1, abruptio placentae 1, undetermined 1		
B. Neonatal deaths	11	15.6
Respiratory problems 6, cerebral hemorrhage, undetermined 4		

TABLE XII. COMPARISON OF MATERNAL OR FETAL MORTALITY FROM VAGINAL AND ABDOMINAL DELIVERY AT CRAWFORD W. LONG MEMORIAL HOSPITAL

YEAR	TOTAL BIRTHS	MATERNAL DEATHS	STILL-BIRTHS	NEONATAL DEATHS		FETAL LOSS	
				PREMATURE	TERM	NO.	%
1948	5,157	6	74	38	20	112	2.5
1949	5,436	3	76	44	28	148	2.6
1950	5,339	1	49	47	30	126	2.5
1951	5,561	1	67	68	32	167	3.2
1952	5,461	0	64	64	13	141	2.5
Total	26,954	11	330	261	123	694	2.6
Sections	524	1	7	11	8	24	4.8

Comment

We believe that analysis of cesarean section at the Crawford W. Long Memorial Hospital for the past five years presents a picture of what the average American woman can expect from this phase of management of her obstetrical problem despite the exclusion of Negroes and all but a small number of indigents from the series. The fact that our institution is an open staff general hospital with a substantial number of deliveries conducted by nonspecialists in obstetrics gives the study a significance which cannot be obtained by other series of comparable size. We believe that our relatively low incidence of abdominal delivery reflects a healthy attitude toward obstetric problems and that this is proved by our maternal and fetal loss rates as compared to those of other institutions. A low incidence of cesarean delivery characterizes Atlanta obstetrics as a whole, and a city-wide survey should prove to be of interest.

It is our impression that the long-accepted definition of maternal morbidity as "elevation of temperature to 100.4° F. on two or more successive days of the puerperium except the day of delivery" will not adequately disclose the hazard of the puerpera, either vaginally or abdominally delivered, at the present time, due to the widespread use of antibiotics. Rather ironically, the use of an antibiotic was the direct cause of the only maternal death in this study.

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Discussion

DR. O. HUNTER JONES, Charlotte, N. C.—At the South Atlantic Meeting last year I talked on the trend in cesarean section in recent years. As a basis for this paper, I reviewed all sections done at Charlotte Memorial Hospital, Charlotte, North Carolina. Our section rate for the twelve-year period averaged 4.5 per cent, but this rate has been increasing in recent years and in 1952, for example, was 5.6 per cent. My conclusion was that a rate of about 6 per cent in our hospital was adequate, since with this increase in rate there had been a corresponding reduction in both traumatic vaginal deliveries and also preventable term fetal deaths to less than 1 per cent. This formula was originally proposed by D'Esopo of The Sloane Hospital in New York.

Dr. Williams and his associates have given the fetal salvage rate. They did not attempt, however, to show the number of preventable term fetal deaths nor did they show the number of traumatic vaginal deliveries. It seems that this is true of most of the articles published on cesarean section. After all, we have to have something to use as a standard or criterion for cesarean section. This formula of D'Esopo is a very practical answer.

It is interesting, although somewhat disappointing to me personally, that in the past year (1953) the section rate at Charlotte Memorial Hospital was down from 5.6 per cent (1952) to 4.4 per cent, and while the preventable term fetal deaths were still under 1 per cent, and actually fewer than in 1952, still the number of traumatic vaginal deliveries was increased to 1.2 per cent. In other words, if the section rate drops, the number of traumatic vaginal deliveries automatically increases. While the fact that we actually lost fewer babies is gratifying, it is still disturbing to me that our staff elected to do more hard midforceps and difficult vaginal breech deliveries last year. Now, I wonder also what the later mental status of these babies will be, even though most of them appeared to be all right. Certainly, as stressed by the late Howard Moloy, our knowledge is incomplete regarding this follow-up mental status.

It seems to me that until it can be shown beyond any reasonable doubt that these babies will not suffer any permanent brain damage, the wise obstetrician will keep his section rate high enough to do away with the necessity for traumatic or hard vaginal delivery—not only for the baby's sake but also for the mother's sake. I want to repeat again what I said last year, namely, that survival alone, both maternal and fetal, is not enough.

DR. MANLY E. HUTCHINSON, Columbia, S. C.—It may be interesting to see an analysis of the cesarean sections done in a Columbia hospital which has an open staff and serves both private and ward, as well as white and Negro, patients. This study is intended primarily to show the section rate and the relative percentages in various types of patients and of specialists and nonspecialists in obstetrics.

Although this study covers a period of only one year, 1952, it is believed to be fairly representative of the practice in this hospital and in most hospitals of similar type.

Table I shows the indications for sections, as well as could be determined from the records. As in most studies of this kind, previous sections, cephalopelvic disproportion, and uterine bleeding are the most frequent indications, almost 73 per cent in this study. Almost two-thirds of these, with 2 each of prolapse of cord, toxemia, abdominal pregnancy, and dystocia with inertia, and 1 previous myomectomy, were done by obstetrical specialists.

TABLE I. INDICATIONS FOR ALL SECTIONS (TOTAL 88)

	OBSTETRICIAN-GYNECOLOGIST	SURGEON	TOTAL	PER CENT
1. Previous cesarean section	22	13	35	39.8
2. Cephalopelvic disproportion	13	7	20	22.8
3. Abruptio placentae	5	1	6	6.8
4. Placenta previa	2	1	3	3.4
5. For sterilization only	–	3	3	3.4
6. No indication recorded	–	3	3	3.4
7. Prolapse of umbilical cord	2	–	2	2.29
8. Toxemia (1 postpartum eclapmsia, 1 pre-eclampsia)	2	–	2	2.29
9. Abdominal pregnancy	2	–	2	2.29
10. Cervical stenosis (no dystocia)	–	2	2	2.29
11. Therapeutic abortion (1 hyperemesis, 1 glomerulonephritis)	–	2	2	2.29
12. Dystocia with inertia	2	–	2	2.29
13. Previous myomectomy	1	–	1	1.14
14. Previous difficult labor	–	1	1	1.14
15. Fibromyoma in birth canal	–	1	1	1.14
16. Postmortem (patient died during removal of intrathoracic thyroid)	–	1	1	1.14
17. Cerebral vascular hemorrhage	–	1	1	1.14
18. Breech (no labor, membranes ruptured 36 hours, meconium in vagina)	–	1	1	1.14

There were 3 sections done for sterilization only, 3 with no indication recorded, 2 for cervical stenosis (no dystocia), 2 for therapeutic abortion (abdominal hysterotomy), and 1 each for previous difficult labor, fibromyoma of birth canal, cerebral vascular hemorrhage, and breech presentation. There was 1 postmortem section. These were all done by general surgeons.

In Table II it will be seen that slightly more than half of the number delivered were Negroes. There were about two and one-half times as many private as staff deliveries. Of the private deliveries, the general practitioners and general surgeons delivered more than two and one-half times as many as did the specialists in obstetrics. If the staff cases, which were done by the obstetrical service, are included, the general practitioners and general surgeons delivered over half.

TABLE II. TOTAL DELIVERIES (1952)

	TOTAL	WHITE	NEGRO	PRIVATE	STAFF	PRIVATE OBSTETRICIANS AND GYNECOLOGISTS	PRIVATE GENERAL PRACTITIONERS AND SURGEONS
No.	1,600	794	806	1,144	456	318	826
Per cent		48.6	51.4	71.5	28.5	19.9	51.6

The hospital's section rate was 5.5 per cent (Table III). The rate was almost twice as high in the white as in the Negro patients and two and one-half times as high in the private as in the staff patients. In private patients, the rate of the obstetrical specialists was two and one-half times that of the nonobstetrical attendants. However, if the staff cases are included, the rate for the obstetrical specialists is 6.3, or 1.6 per cent higher than that for the nonobstetricians.

Of the 37 sections done on private patients by obstetrical specialists, 6 were classical, 2 were abdominal pregnancies, 1 was a Porro, and the others low-flap operations (Table IV). Of the 39 sections done by nonobstetrical attendants, 1 was a low-flap operation, 2 were therapeutic abortions (abdominal hysterotomies at 3 to 4 months), 1 a Porro, and the others classical. The specialists had a mortality rate of 2.7 per cent, a morbidity rate

of 29.7 per cent, and obtained obstetrical consultations in 66.2 per cent. The nonspecialists' mortality rate was 5 per cent, morbidity 12.5 per cent, and they had no obstetrical consultations.

TABLE III. CESAREAN SECTIONS (1952)

	TOTAL	WHITE	NEGRO	PRIVATE	STAFF	PRIVATE OBSTETRICIANS AND GYNECOLOGISTS	PRIVATE GENERAL PRACTITIONERS AND SURGEONS
No.	88	55	33	76	12	37	39
Per cent	5.5	6.9	4.0	6.6	2.6	11.6	4.7

TABLE IV. OPERATORS (PRIVATE) (1952)

		TOTAL	CLASSICAL	LOW	ABDOMINAL PREGNANCY	THERAPEUTIC ABORTION	PORRO	MORTALITY	MORBIDITY	OBTAINED OBSTETRICAL CONSULTATION
Obstetrician and gynecologist	No.	37	6	28	2	–	1	1	11	25
	Per cent	48.7	16.2	75.6	5.5	–	2.7	2.7	29.7	66.2
Surgeon	No.	39	35	1	–	2	1	2	5	–
	Per cent	51.3	90	2.5	–	5	2.5	5	12.5	–

The results of these studies presents several questions: What can we do in this type of hospital to improve obstetrical care, which includes the condition of the newborn baby at the time of delivery? Why is the section rate higher in the white than in the Negro patients? Why is it higher in the private than the staff patients and why is it so much higher in the private patients cared for by obstetrical specialists than it is in the staff patients whom they also attend? Why is obstetrical consultation not indulged in more frequently?

Several investigators have reported that babies delivered by cesarean section after eight or more hours of test labor do better than those delivered without it. It is suggested that a test of labor, in selected cases and under close supervision, of course, may accomplish several things: (1) It may result in a satisfactory vaginal delivery. (2) The lower uterine segment would be better developed for section. (3) There would be fewer premature babies delivered. (4) The babies would probably be better prepared, physiologically, for postnatal existence.

Undoubtedly many sections have been done that should not have been done and many have not been done that should have been done. The section rate of an individual or institution is not so important. What is best, in the individualized case, for the mother and baby is important.

It seems reasonable to suppose that if honest and sincere obstetrical consultations were requested and received, as is required by staff rules in most of these hospitals, the pregnant women would be benefited.

LT. COL. JOHN S. ZELENIK, MC, Fort Benning, Ga.—I was particularly interested in the data on cesarean sections presented by Dr. Williams and his associates because of their low rate with good fetal salvage. One is always concerned over the possibility that more frequent use of cesarean section might have prevented future damage to some infants.

In reviewing our cesarean sections for the past three years I find that we had a rate of 1.4 per cent. Our three-year series does not include the large number of deliveries reported by Dr. Williams, but consists of almost 6,300 deliveries, of which 89 were by cesarean section. In this number are included approximately 13 per cent Negro patients,

which is fairly close to the national proportion. In addition, most of the sections done were repeat sections, so that much less than 1 per cent of the total deliveries were accomplished by cesarean section as a primary operation elected by us.

Our indications for sections, aside from the repeat sections, have been a little different than the Crawford Long group. The highest number were done for hemorrhage, which included both placenta previa and abruptio placentae. The next, but with a much lesser incidence, were for inertia and abnormal presentations. Following this came disproportion. Rarely was a cesarean section done because of toxemia.

The anesthesia used was principally a spinal block, using Pontocaine. Occasionally, where a rapid section had to be performed, Pentothal was used. Pentothal was invariably given following the delivery of the baby when spinal anesthesia was used.

In every instance the low transverse cervical operation was used. No incidental surgery was done except tubal ligation where sterilization was indicated.

There were no maternal deaths in this series. There were two stillbirths and two neonatal deaths, making an over-all cesarean section infant loss of 4.4 per cent.

Since cesarean section rates vary so much throughout the country, from as low as 1 per cent or less, as reported by the Grady group, to as high as nearly 10 per cent, as reported in some of the western hospitals, it seems that some basis for comparison and evaluation must be established. I do not believe that maternal mortality alone can be used for this basis, for, if we were to compare the two groups, one would get the impression that the higher the section rate the lower the maternal mortality. I very strongly suspect that both groups are losing the same type of patient and that increasing the rate of sections would reduce the incidence of mortality, for if we were to increase the section rate by ten times in the lowest group and not lose any more mothers, the mortality incidence between the two extremes would be comparable. The next criterion for comparison could be fetal wastage. It would seem that if infants were traumatically delivered, the incidence of fetal wastage would be higher. Certainly, no one has any argument with the fetal loss of the group at the Crawford W. Long Hospital.

The argument that is presented by the enthusiasts for increasing the incidence of cesarean sections is chiefly that we may be turning out some infant imbeciles by refusing to increase our section rates. It seems that the burden of proof lies with these enthusiasts.

When a physician is responsible for over 2,000 deliveries each year, he does considerable soul-searching when he finds that his cesarean section rate is considerably lower than the average. He wonders if these "horrible things" are actually occurring to the infants delivered on his service. Dr. Williams and his cohorts have made us feel more secure in our position.

DR. WILLIAMS (Closing).—This study is the result of an effort to give our residents a more comprehensive view of obstetrics than they might otherwise get in a nonteaching hospital. Crawford W. Long Memorial Hospital is owned by the Emory University School of Medicine and staffed largely by its volunteer clinical faculty, but no undergraduate teaching is done there. We expected controversy and accept the criticism in good spirit. It has been inferred that Atlanta's conservatism toward cesarean section may be resulting in handicapped children. The answer cannot be given in a study of this kind but might, perhaps, involve an extended follow-up to see who becomes who in sixth grade arithmetic. Seriously, our pathologists, like Dr. George Anderson of Baltimore and others, say that autopsy findings of skull fractures, subdural hematomas, tentorial tears, and other evidences of obvious traumatic delivery are now rather rare, but the picture of cerebral damage due to anoxia, either ante partum, intra partum, or in the early neonatal period, is far too common. There is much evidence that some of the gross lesions such as basilar hemorrhage, which we have previously accepted as traumatic in origin, are often due to anoxia. This being the case, it seems to me that the proponents of wider use of abdominal delivery must answer for the effects on the baby of maternal shock, surgical degrees of anesthesia, aspiration of blood and amniotic fluid, faulty estimation of fetal maturity in the inevitable pyramiding of "repeat sections," etc., before we can concede to them.

APRESOLINE (HYDRALAZINE HYDROCHLORIDE) AND ITS USE IN CASES OF HYPERTENSIVE PREGNANCY*

WILLIAM K. JORDAN, M.D., MACON, GA.

(From the Macon Hospital)

AS REPORTS come in on the new antihypertensive drugs, it becomes increasingly evident that Apresoline† may be indicated in the treatment of hypertensive toxemias of pregnancy. At the Macon Hospital we are trying to evaluate the clinical worth of Apresoline. Concurrently, this is being carried on at several medical centers across the country. Preliminary reports from each are encouraging. We concluded, therefore, that a review of the literature and a summary of four of our cases might be of timely interest.

Ten other cases, treated early in this series, were approached with undue caution. These were given Apresoline by mouth in combination with our established routine of magnesium sulfate, barbiturates, and 5 per cent glucose. Satisfactory lowering of blood pressure occurred and, in our opinion, was probably enhanced by the use of Apresoline.

Apresoline, or Hydralazine hydrochloride (1-hydrazinophthalazine hydrochloride), has a central action as shown by clinical and laboratory investigations, involves no sedative component, and results in the lowering of diastolic as well as systolic pressures in hypertension of diverse etiology. It has a unique influence on certain centers of the nervous system and its chief locus of action appears to be in the midbrain.[2, 9, 10]

The hypotensive response to Apresoline usually persists for long periods of time as administration of the drug is continued,[4, 7] and many patients have been treated for nearly two years. It provides a gradual and sustained reduction of blood pressure—diastolic showing greater fall than systolic.[1] Renal plasma flow is increased in marked contrast to the decrease associated with use of other hypotensive agents.[1] Urinary output is not decreased, and with the use of 5 per cent glucose in distilled water (up to 3,000 or 4,000 ml. intravenously in twenty-four hours) it is actually increased according to some doctors.[1, 9] Apresoline produces a significant reduction in cerebral vascular tone, increasing blood flow,[9] but no significant increase in oxygen consumption.

In pre-eclampsia (presence of elevated blood pressure, albuminuria, and edema during the last trimester of pregnancy), there is an almost dramatic fall in blood pressure[1]; to a lesser degree the same effect is brought about in pre-eclampsia superimposed on essential hypertension. Tetraethylammonium chloride (TEAC) has been used as a screening agent between the two above

*Presented at the Fifteenth Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Havana, Cuba, Jan. 29, 30, and 31, 1953.

†Ciba Pharmaceutical Products, Inc.

classifications, since the intravenous administration of 400 mg. (4 ml.) will bring about a marked drop in blood pressure in essential hypertension but has little or no effect in pre-eclampsia.[9] Because of its evanescent effect, it does not disturb interpretation of later results. Testing is usually done at least thirty minutes prior to the administration of Apresoline.

The recommended procedure for administration of Apresoline parenterally is as follows:

1. Put the patient to bed in the hospital.
2. Record control blood pressure reading every five minutes for one-half hour.
3. Give Apresoline intravenously at a very slow rate of injection in doses ranging from 20 to 40 mg. We diluted 20 mg. up to 20 ml. with distilled water in order to control more easily the slow administration; others have given 20 to 40 mg. in 500 ml. of 5 per cent glucose in distilled water at a slow drip.[12]
4. Record blood pressure and pulse reading every minute until an appreciable drop is obtained or 40 mg. has been given, then every five minutes for one hour, and thereafter every thirty minutes until blood pressure returns to control levels (sometimes as long as twenty-five hours).
5. Give a repeat dose when control level is reached.
6. After blood pressure has reached the desired level, it may be checked less frequently and dosage repeated only when necessary.

Some clinics and hospitals give oral tablets, starting with 10 mg. after meals and at bedtime for the first two to four days; 25 mg. after meals and at bedtime for the balance of first week; and in like manner 50 mg. for the second week, 75 mg. for the third week, and 100 mg. for the fourth week and thereafter. Some even give larger doses where required to reduce blood pressure to the desired level. We think the oral method offers possibilities in early and mild pre-eclamptic ambulatory clinic patients.

Ambulatory patients should be checked frequently—at least once daily—until blood pressure has stabilized. Considerable difficulty may be avoided by judiciously forewarning the patient of the possible appearance of certain side effects, usually transient. Palpitation and a sensation of warmth are the most frequent complaints,[1, 9] followed by headaches (sometimes accompanied by nasal stuffiness, lacrimation, and conjunctival injection which can be relieved by antihistaminic agents). The headache is usually described as a "throbbing fullness of the head" and, if not transient, can usually be relieved by aspirin. However, a very occasional headache has been reported severe enough to require cessation of the Apresoline.[12] Nausea and vomiting, anxiety, restlessness, and epigastric pain are additional complaints reported in a few instances. These side effects present no relationship to the magnitude of response to the drug, although some believe a drop in blood pressure can produce most of the above symptoms.[9]

Side effects, when they do occur, often disappear as therapy is continued or can be ameliorated with adjunctive therapy.[9] This lessening or disappearance of complaints was noticed in 30 per cent of individuals who received more than two intravenous doses in Assali's series of 72 cases.[1] Side effects

are minimal when dosage is carefully individualized and low doses are used initially with only very gradual increase. Response of the individual should be a guide to appropriate adjustment and spacing of doses.

Dr. Robert W. Kistner, after comparing the use of Veratrum compounds and the use of Apresoline in treatment of toxemia of pregnancy, stated:

"If the results so far obtained are valid, it would seem that Apresoline has simplified the treatment of toxemia. In pre-eclampsia, adequate hypotension may be obtained without the excessive nausea and vomiting of the veratrum compounds.

"It (Apresoline) is simple to give by single shot technique and needs no elaborate apparatus such as is necessary for continuous spinal and caudal.

"It obviates the extremes of central nervous system and respiratory depression seen with magnesium sulfate, barbiturates, morphine and chloral hydrate together with their resultant fetal effects.

"Physiologic studies indicate increased blood flow to organs generally believed to be ischemic in this disease.

"Combination therapy with tetraethyl ammonium chloride, hexamethonium and the newer veratrum compounds has suggested that even more beneficial results may be obtained. No serious toxic effects have, to date, been attributed to the drug."

In regard to the use of Apresoline for toxemias of pregnancy, Dr. Milton L. McCall of Philadelphia states, "In some instances great improvement has taken place and pregnancy has been allowed to continue in some patients which I am sure could not have continued without this medication."

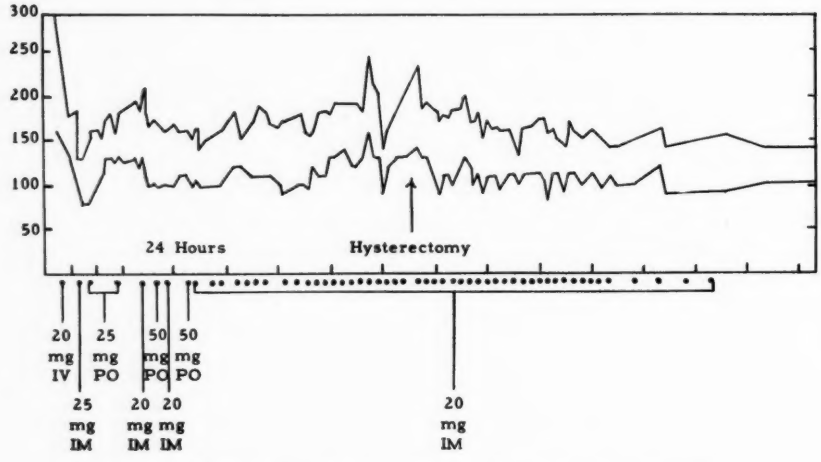

Fig. 1.—Case 1. Blood pressure regulation with Apresoline.

Case Reports

CASE 1.—M. M., a Negro woman, aged 29 years, gravida viii, para vi, abortus ii, was referred to Macon Hospital by a local doctor because of high blood pressure and albuminuria. On admission she was approximately 4½ months pregnant. Blood pressure was 280/160 and 3-plus albuminuria was found (Fig. 1).

CASE 2.—Mrs. C. M., a white woman, aged 31 years, gravida v, para i, abortus iii, a known essential hypertension case with a systolic pressure of 120-160 prior to this preg-

nancy, was admitted to the hospital with history of slight symptoms of toxemia for about two to three weeks and a very severe pain in her head and neck of a few hours' duration. Blood pressure on admission was 210/130; urine showed 3 plus albumin with occasional finely granular and coarsely granular casts, an occasional pus cast, and white blood cells in clumps. Uric acid was 4.8 mg. (Fig. 2).

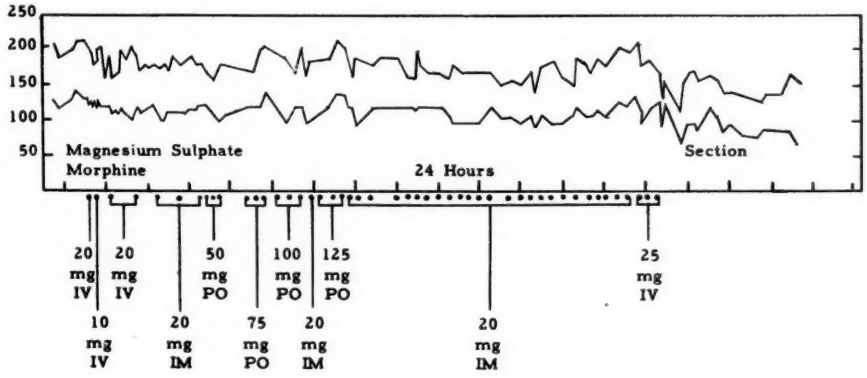

Fig. 2.—Case 2. Blood pressure regulation with Apresoline.

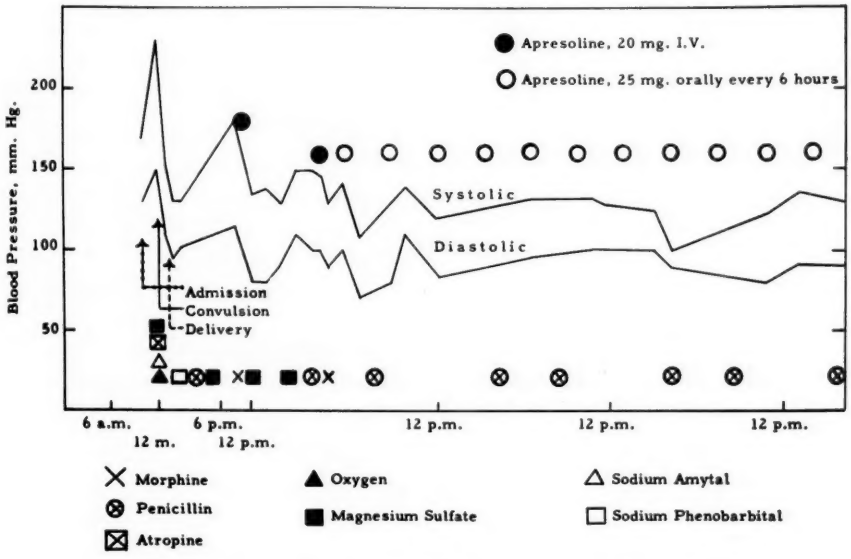

Fig. 3.—Case 3. Use of Apresoline in an eclamptic patient.

CASE 3.—M. G., a Negro woman, aged 30 years, gravida ii, para i, was a clinic patient with a normal antepartum course until the day of admission. A true eclamptic convulsion occurred a half-hour after admission (Fig. 3).

CASE 4.—V. H., a Negro woman, aged 32 years, gravida vii, para vi, was first seen in a nearby town eight days before admission to Macon Hospital, at which time she refused hospitalization. She was within three weeks of the estimated date of confinement and her blood pressure was 220/130. She had a 3 plus edema of feet and ankles and 3 plus albuminuria (Fig. 4).

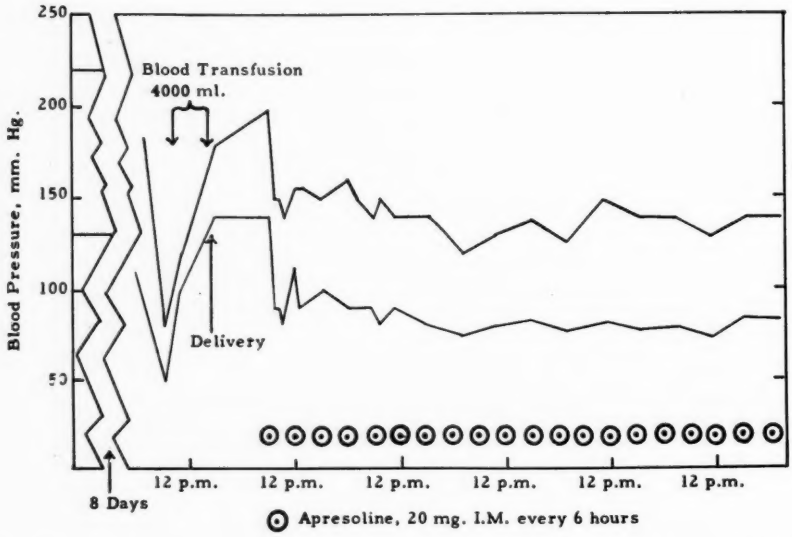

Fig. 4.—Case 4. Use of Apresoline in a patient with very high initial blood pressure.

Conclusions

Four cases of pre-eclampsia and eclampsia by Apresoline are presented. It is hoped that successful results in use of this new agent will inspire others to investigate its possibilities to the fullest. My main purpose in presenting this limited number of cases is to stimulate interest in its use. At present only one large center in the South Atlantic area is doing research on it. As all available sources have been reviewed, it seems very probable that a general use of Apresoline under many different conditions will prove its true worth.

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Original Communications

FEBRILE INDEX—A MODIFICATION AFTER D'ESOPO*

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A METHOD for the interpretation of the degree of elevation of temperature and the duration of the elevation above an arbitrary level was suggested by D'Esopo[1] in 1950 to provide a simple but practical means of communication between doctors without the need for diagrams, graphs, or lengthy descriptions. This suggestion is especially appropriate in obstetrics and gynecology, for there are really no easily definable terms to indicate the degree or severity of an infection, whether it is a bacteriemia, peritonitis, or other infectious process. The same situation applies to the severity of toxemias of pregnancy or to the extent and severity of blood loss and shock. Perhaps an adaption of D'Esopo's idea could be employed for these complications too.

D'Esopo labeled his method the "febrile index." His index does not incorporate white blood cell counts nor pulse rate alterations. The addition of these factors might make the system too complex. At first thought the expression seems alien and foreign but after a little observation and study it presents an over-all average of the thermal response in the host and the duration of febrile reaction. It permits a specific concrete expression of abnormal body temperature in an easily understood method. Comprehension and interpretation evolve on precise tools. In short, it replaces the verbosity of sentences with the potential likelihood of misunderstanding.

In the method of D'Esopo the temperature of 99° F. is taken as normal. He counts each tenth of a degree above normal for the single highest point of each day and then adds these together. After the total is obtained, the decimal point is removed (or the number may be multiplied by ten). This yields a whole number. This whole number represents the total febrile accumulation as multiplied by ten. The elimination of decimal or fraction eliminates antipathy or reticence of many who dislike decimals or fractions. Whether one leaves the totals in the decimal state or converts to a whole number, the relative value is constant.

Good argument prevails for a modification of the evaluation of febricity in view of improved therapy and patient care. Moreover, in most good obstetrical units there are but few patients who could be termed febrile by standards of the American Committee. Although infections take place, often these respond so quickly to therapy that the course of "yonder day" is rare.

*Supported in part by the Fiftieth Anniversary Fund on Eclampsia and Puerperal Fever.

D'Esopo eliminated the first day from his scale, a decision with which we take exception. It seems that the use of 99° F. is too low because the standard physiological texts subscribe to the concept that normal body temperature varies up to 99° F. or 37.7° C. With this standard well established, a modification of D'Esopo's proposal was investigated. On such a program one begins with 37.7 as the first tenth of a degree on the centigrade system, and counts each one-tenth of a degree upward for the single highest daily reading. The totals for each of the highest daily observations represent the sum in actual measure. Because these totals frequently will be in decimals, it appeared practical to convert this decimal number to a whole number. This step is accomplished by the elimination of the decimal point or simply by multiplying the sum by ten. This number is the febrile index. In order to have a relative value, the number of days involved should be so indicated. Accordingly then, the adjusted number is followed by a dash and the number of days of body temperature above the physiological level.

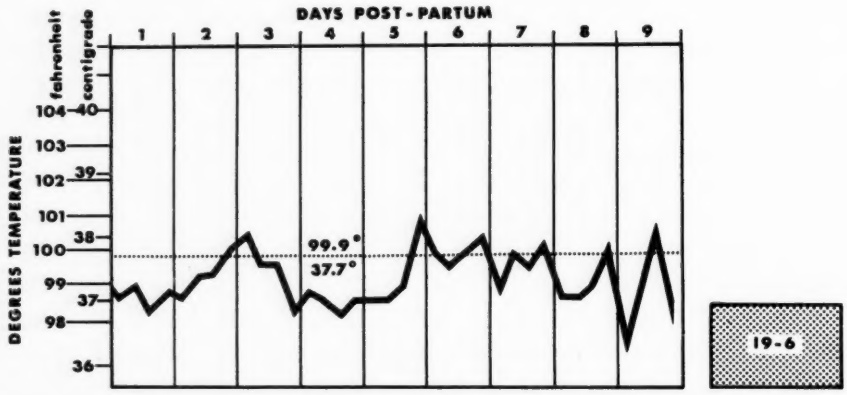

Fig. 1.—Mrs. R. Illustrates a mild febrile course. The block represents the average elevation of temperature graphed against the number of days of temperature elevation.

Illustrations of this idea by means of charts or graphs assist the reader to comprehend the method. Accordingly, a number of temperature charts were converted to this modified febrile index system and the extent of elevation shown by block graph. The temperature is averaged for the number of days and graphed on the abscissa. The days are indicated on the ordinate. The usefulness of this modification was shown by Hesseltine, Bustamante, and Loth,[2] in a special study on the influence of antibiotics on the intrauterine puerperal flora and postpartum course.

Illustrative temperature graphs from cases on the service exemplify the working method of the systems. Thus, in Fig. 1, one will note on the second day a one-tenth of a degree elevation; on the third day there was three-tenths of a degree of elevation; on the fifth day, five-tenths of a degree elevation; on the sixth day, three-tenths of a degree; on the seventh, two-tenths of a degree; on the eighth, one-tenth; on the ninth, four-tenths of a degree elevation. This produces a total of 1.9° C. elevation. Multiplication by ten removes the

decimal point with a resultant whole number of 19 as the index for a period of six days. With the temperature graph will be a block graph for comparison and also the numerical expression. The abscissa indicates the total number of degrees above 37.7° C. multiplied by 10 and then averaged for the duration. The ordinate indicates the number of days of elevated temperature course. The average is 3.16 units for six days.

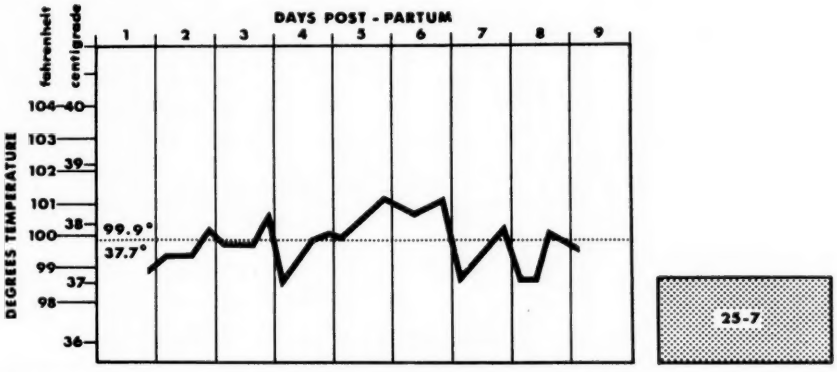

Fig. 2.—Mrs. L. Illustrates in graph and block average daily temperature elevation and longer course.

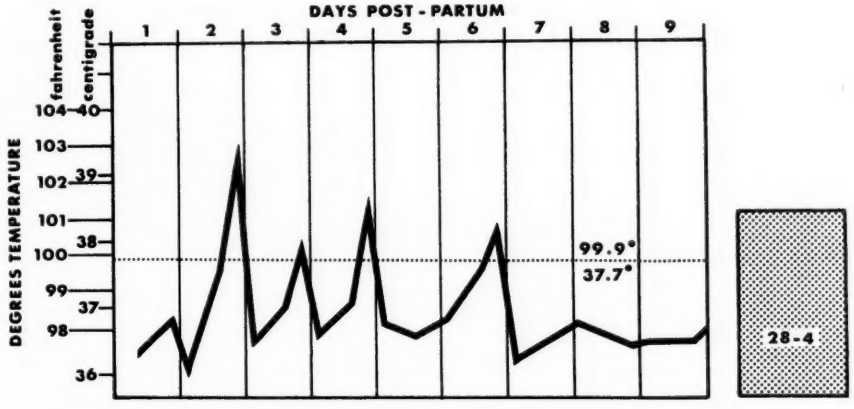

Fig. 3.—Mrs. D. Illustrates in graph and block the total febrile reaction.

Fig. 2 has a total of 2.5° C. elevation or a whole number of 25. The duration was seven days. This means an average elevation of 3.57 units daily for seven days. In actual facts, the average daily elevation, above 37.7° for the seven days, was 0.357° C.

Fig. 3 shows in four days' time a total of 2.8° elevation, or actually a number of 28. In direct reading this represents but 0.7° C. The block at the end again represents the graph.

Fig. 4 indicates a more severely infected patient with a total of 5.5° or a whole number of 55, for a duration of four days. This is an average of 13.75 units per day.

Fig. 5 depicts by temperature graph an acutely ill patient. This graph reveals 7° C. above the 37.7° level, or a whole number of 70 for five days. This produces an average of 14 units per day.

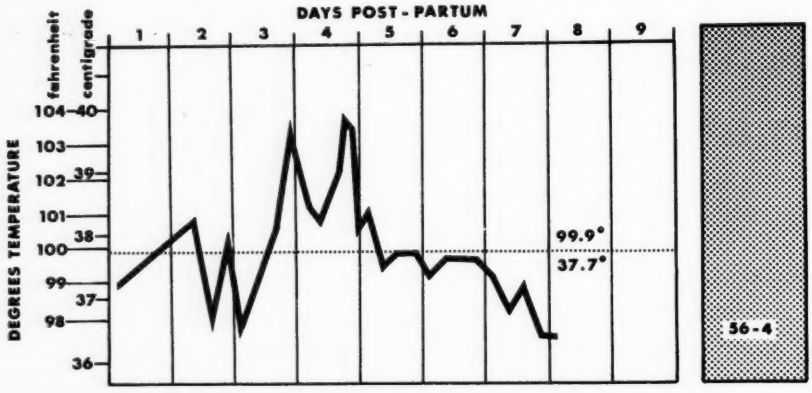

Fig. 4.—Mrs. T. Illustrates the graph and block interpretation of pronounced fever.

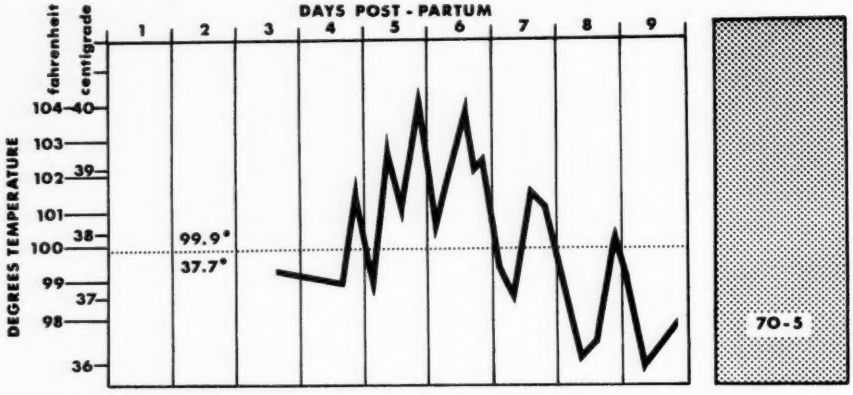

Fig. 5.—Mrs. G. Reveals the comparative expressions of febrile reaction from a septic course.

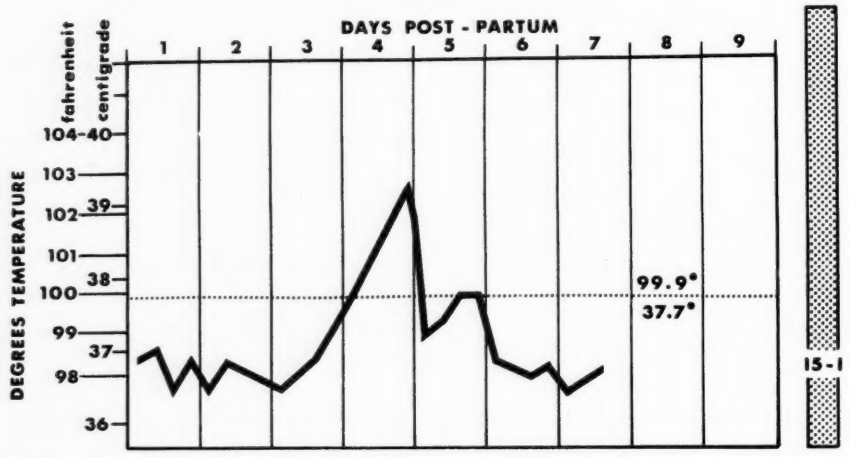

Fig. 6.—Mrs. S. Indicates intensity of temperature reaction although afebrile by American Committee standards.

Fig. 6 indicates only a single-day temperature rise for a total of 1.5°, or 15, a whole number.

On comparison of these graphs and charts individually and then by block graph (Fig. 7), it will be noticed that the height indicates the mean average per day for the number of days of elevations. These are visual means to emphasize the practical method of translation. These block patterns are specifically concrete. It requires but time to calculate the total. The method is simple and specific, yet descriptive. The graphs and blocks are offered as visual aids to interpret the colorless but concrete numbers.

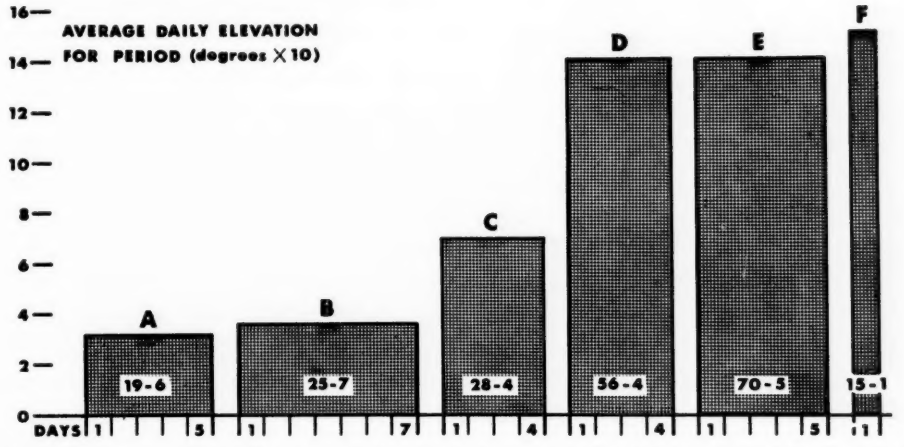

Fig. 7.—Shows the comparative temperature reaction, graphing the average daily temperature (in tenths of degrees) above 37.7° C. against the number of days of such course.

The same plan will work in the Fahrenheit scale using the temperatures above 99.9°. This reading is practically the same as 37.7° C. It is recommended the scale employed be so indicated, but, even without doing so, there is not much contrast. The range in number from 99.9 to 104 is 4.1, while from 37.7 to 40 is but 2.3, yet these both express the same variation and the same equivalent uniformally. The number of days is fixed.

Conclusion

1. It is not the intent that blocks or graphs be used entirely, but only as a visual means of expression of the febrile course. The Arabic numbers designate as clearly the total elevation of temperature as the number of days indicates the duration or spread of time.

2. A modification of D'Esopo's proposed febrile index has been presented. The principle of the index is sound. The difference of views arises on the selection of an arbitrary base line for division between normal and pathologic temperature courses. By using an established temperature base, one will avoid having too few or too many readings in the subfebrile category.

3. The febrile index is practical, brief, but exact and descriptive.

4. This method of description and communication is recommended.

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THE VALUE OF HAND SOLUTIONS FOR BIRTH ROOMS

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FOR years it was customary in this and most other maternity services to use an 0.5 per cent solution of a creosol compound or other antiseptic agents for cleansing the gloved hands and in the preparation of vulvar and perineal areas of the patient for delivery. The basin solutions were called "hand solutions." The use of these hand solutions was believed by many to be invaluable as an antiseptic for sterilization of the skin, perineum, and the gloves. Even so, the procedure was not without risk since an occasional patient would have a reaction to the solution. These reactions were referred to as a chemical burn. The areas involved were the perineum, sacrum, and not infrequently the thigh and lower abdomen. Rarely there would be a severe dermatologic response. The reassuring odor contributed to a false sense of security in that too often it was believed that complete protection was assured. Documentary evidence in recent years has demonstrated that most agents which can be applied safely to the human body will not kill bacteria in those clinically usable concentrations without prolonged exposure (from several minutes to hours). Thus the idea of antisepsis by the simple washing of gloves has been shown to be inadequate in time exposure. Then, consequently, for aseptic purposes it would be necessary to have prolonged exposure of the contaminated glove. For this reason it is imperative to remove contaminated gloves and put on sterile ones.

It is known that the number and type of bacteria upon the skin or in cavities which communicate with the outside, as the vagina and vulva, may be altered or reduced somewhat by mechanical and by antiseptic agents. However, with the modern-day bacteriologic techniques of both aerobic and anaerobic methods and the elimination of the supposedly active ingredients from the test material, the inability to sterilize and keep sterile the human skin or the vagina has been demonstrated adequately. The usual method of washing the perineum with soap and water in the preparation of patients for delivery undoubtedly reduced the number of organisms to a considerable degree. Soap and water have survived as one of the best ways to cleanse many areas and sites. The usual perineal preparation for delivery in this institution consists of the vulvar and perineal shave as the first step. The next step is a gentle wash with a sterile soapy solution. An enema is usually given next but whether or not an enema is given the patient receives a shower bath except

when the progress of labor allows insufficient time. For a number of years, a most thorough wash and scrub were given to the pubic, perineal, upper thigh, and lower abdominal areas. In the more recent years this procedure has been reduced greatly. Antiseptics, more often in a tincture vehicle, are applied to the external genitals, after a limited washing with a mild soap and water. When patients are not anesthetized then aqueous solution is substituted for the alcohol and acetone carriers.

This study was instituted to see if there was any apparent value of hand solutions. If value was undiscovered, then a frank approach should be made. Any false concepts should be corrected and the truth presented. If the hand solutions were used incorrectly for sterilization of gloved hands, then the error of insufficient treatment needed emphasis.

It should be stated that in this institution solutions are not instilled into the vagina during the course of labor. Bacteriologic studies in various parts of the body support the contention that disturbance of the bacterial flora may be followed by an unfavorable bacterial flora. Thus the insult to the vaginal walls or cervix from labor and the altered bacterial balance might be a contribution to an imbalanced uterine bacterial flora. Because of the various ports of entry for organisms and altered host resistance some organisms might find a favorable nidus. Such infections could be either endogenous or exogenous. Contamination of the birth canal by soiled gloves or by droplets from the respiratory passage and mouth have been recognized as the major sources of exogenous dangers.

Obviously gloved hands can be sterilized by strong chemicidal solutions but it is well demonstrated by bacteriologic technique that it would require the submersion of the gloved hand in the solution (chemically usable) for a protracted period of several minutes or even longer. The process of "going through the hand solution" has become a traditional habit. Admittedly some of the organisms on the contaminated glove could be removed by the simple washing but as the solution is used repeatedly the number of organisms in it will increase and the value of the solution will decrease proportionally. Present-day teaching views on better concepts of microbiology hold that contaminated gloves should be replaced by sterile ones.

Method

With these ideas in mind, it was decided that one should evaluate each of the steps to improve if possible the safety in childbirth and to reduce the hazards of infections or contamination from extrinsic as well as endogenous sources. The birth room techniques remained essentially the same during this period of study of the hand solution except for changes of the hand solutions. The authors were the only ones who knew the contents of the test "hand solutions." The years of 1946-1947 served as a control. The first solutions were made up in the following manner: Several dozen ½ ounce bottles were filled in the research laboratory with a greatly diluted colored aqueous solution of Merthiolate.* These bottles had screw caps. The bottle and contents were treated

*Eli Lilly and Company cooperated generously in supplying the Merthiolate solution for this study.

by autoclave sterilization in the birth room. The contents of these ½ ounce bottles consisted of but 2 c.c. of 1/1,000 Merthiolate solution to 1 gallon of distilled water. This made a final dilution of Merthiolate of about one part in 64,000. This yielded a concentration of 0.22 per cent which by further dilution gave only 0.0034 per cent or approximately one Merthiolate part in 30,000 in the prepared hand solution. Eight grams of eosin was added to each gallon of original Merthiolate stock solution.

One bottle of sterile, colored water was added to the basis of sterile water for hand solution and diluted with sterile water. This colored solution was employed first to imply the use of some antiseptic agent. Some other agent of pronounced odor could have been used. After a period of twelve months the eosin solution and Merthiolate were discontinued completely. It was believed that these extreme dilutions had little or no bactericidal effect in accordance with their use on hand solutions. For a short period both Bismarck brown and brilliant green were subjected to the same test trials of autoclaving and dilutions. Both of these colors lacked the stability and brilliance of eosin. The second 12 months' study ensued with the use of a sterilized solution of an equal amount of eosin in plain water instead of the Merthiolate solution. The personnel in the birth room maintained their usual confidence in the hand solution.

After 24 months of colored solution (mostly eosin, as mentioned above), ½ ounce bottles of sterile water were used as a colorless solution. This clear sterile water was added to the hand basin and the customary sterile dilution was added. After 12 months had passed with the use of plain sterile water, a preliminary report was made to the staff giving a full account. Since then only sterile water has been used as a hand solution. This solution was used to remove blood and like material. If any question of contamination arises, gloves are changed, a policy which has been in effect for a number of years.

Comment

During the 12 months prior to the beginning of this experiment (or the year during which the creosol solution was used) there was a total morbidity rate of 262 cases. There were 4,108 deliveries and there were 40 infected episiotomies. Fig. 1 indicates the course of deliveries beginning in the year 1946-1947. On July 1, 1947, the study with solutions as previously described was instituted. It will be noted that during the next two years there was a slight declining drop in febrile cases (using the standard of the American Committee). The birth rate has tended to decline gradually during the last years.

Except for the year of 1948-1949, the incidence of infected episiotomies dropped appreciably and steadily. In the year 1951-1952, it will be noted that there were almost 3,900 deliveries—exactly 3,849. There were only 112 febrile patients according to the American Committee standards. Infected episiotomies during this year were listed as 7. In the previous year there were 11 and in the year previous to that 18. In the last three years plain sterile water from the sterilizing room has been the only hand solution in the birth rooms. This three-year period, as evaluated by the graph, reveals that sterile water is a satisfactory cleansing agent, while at the same time it does not have the slipperiness of soap nor the potential danger of chemical injury to the patient. The febricity rate is the lowest in recent years. Moreover,

episiotomy wounds healed most satisfactorily. Those few infected episiotomy wounds were no more severe or extensive than those of the preceding era.

The anticipated increase in morbidity or infected episiotomy wounds did not develop. It should be emphasized that chemotherapeutic and antibiotic drugs were used only on indication. Thus protection was not afforded by antibiotics. To be sure, hand solutions represent but one link in the chain of complexity of medical and nursing care.

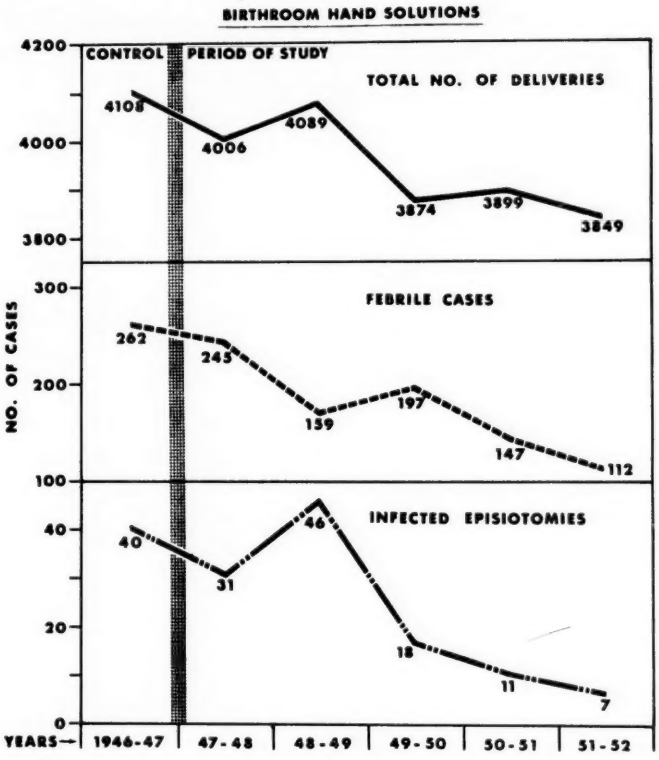

Fig. 1.

Thus, asepsis should be emphasized. It is believed that the antiseptic techniques and procedures lend themselves inadvertently to false security, while it has been shown that sterile water for washing of the gloved hands is perfectly safe. Therefore if there is any suspected or obvious contamination of the glove, the only acceptable technique is to change the gloves.

A lapse of time has been allowed for a full perspective view before making the report. References were omitted, for the established facts are well known.

Conclusions

The institution of sterile water for the hand solution was associated with perfect safety.

It must be emphasized that if any question of contamination arises, the gloves should be removed and sterile ones put on.

The small amounts of Merthiolate and eosin were too dilute to have any prompt bactericidal action. The colored solutions enlisted the cooperation of the staff in this study and established a bridge for the full exploration.

If one is to employ the antiseptic principle for sterilization of contaminated gloves, then one must find an entirely new preparation, for all of the present ones are inadequate in clinical use for immediate sterilization. Thus, the aseptic method with the use of sterile water is adequate for "hand solution."

A false sense of security must be eliminated. Scientific aseptic techniques must be understood and followed.

The use of sterile water avoids the possibility of chemical burns.

Under the conditions of this study and with adequate facilities at command, sterile water is a satisfactory agent for washing the gloved hand of the obstetrician.

STUDIES ON Rh

II. The Antepartum Prediction of Hemolytic Disease in the Newborn With the Aid of Antihuman Globulin Serum

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PRESENT methods for the antepartum evaluation of Rh antibodies present in the sensitized Rh-negative mother have had limited usefulness to the physician who is practicing obstetrics. High Rh antibody titers have been reported in some mothers; yet their infants have had no disease or the infants may have been Rh negative.[1, 2] Low antibody titers have been reported in occasional mothers; yet their infants have been severely damaged.

The unsatisfactory correlation between the degree of antibody titer in the mother and the degree of disease in the infant is causing physicians to disregard any Rh antibody titer studies on the mother. Many physicians are beginning to rely, for the purpose of prognostication, entirely on a history of previous serious disease in an infant. Others do their studies only on the infant after delivery, disregarding entirely the antepartum studies on the mother. Current methods frequently prove to be of little help in the management of the first infant that becomes affected by the hemolytic process.

We have previously reported on our evaluation of the use of antihuman globulin serum in the prenatal study of hemolytic disease of the newborn.[3] Further studies with this same serum confirm our earlier impression that a more helpful aid is now available to the clinician in the antepartum prediction of hemolytic disease in the newborn. It is the purpose of this paper to report this additional study and its significance.

Method

All patients who present themselves to the prenatal clinic have a routine slide test[4] to determine the presence or absence of the Rh factor. When an Rh-negative type is reported, the patient is rechecked and the Rh types of her husband and children are determined if they are available. The tube test[5] is performed on all patients to determine the presence or absence of the Rh factors (C, D, and E). All Rh-negative patients have the Hr factors (c and e) determined. Thereafter, on each visit to the prenatal clinic a sample of blood is drawn from the Rh-negative patient and saline, albumin, and antihuman globulin titers are determined. Usually these are done at four-week intervals to the thirtieth week of gestation, two-week intervals to the thirty-sixth week, and weekly in the last four weeks. If titers are unusually high, or if they are developing rapidly, more frequent determinations are made.

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Material

The current study includes all of the patients delivered in our hospital from March 1, 1952, through June 30, 1953. However, the pertinent information from our first series is also included for this report, so that the combined study includes 4,992 infants delivered from Feb. 1, 1951, through June 30, 1953. There were 819 Rh-negative mothers in this combined group. Sixty-five developed Rh antibody titers of some type. (The incidence of Rh-negative patients with antibodies is greater than expected because of the referral of patients with previously determined antibodies to our service for follow-up.)

The material was divided into two groups—those with albumin titers alone, and those with both albumin and globulin titers. (Saline titers were not considered informative; although routinely done, they are not being reported.)

The first group (Table I) consisted of 31 mothers. The highest albumin titer obtained at any time during the prenatal period is recorded. The results on the infants' Rh types and Coombs' test are also given. No antihuman globulin titers were found in this group.

TABLE I. CASES IN WHICH ALBUMIN ANTIBODIES WERE DEMONSTRATED BUT NO GLOBULIN ANTIBODIES COULD BE DEMONSTRATED

The highest albumin titer found at any time during the prenatal period is recorded. The infants' Rh types and the results of their Coombs' tests are shown.

CASE	HIGHEST ALBUMIN TITER	INFANT'S Rh TYPE	INFANT'S COOMBS' TEST
T. M.	1:2	Positive	Negative
W. D.	1:2	Negative	Negative
3.*	1:2	Positive	Negative
J. Mc.	1:2	Negative	Negative
F. T.	1:4	Negative	Negative
2.*	1:4	Positive	Negative
A. D.	1:4	Positive	Negative
H. D.	1:4	Positive	Negative
A. G.	1:4	Positive	Negative
B. Mc.	1:8	Positive	Negative
A. R.	1:8	Negative	Negative
E. P.	1:8	Positive	Negative
D. G.	1:8	Negative	Negative
J. T.	1:8	Positive	Negative
P. W.	1:8	Positive	Negative
1.*	1:8	Positive	Negative
J. McL.	1:8	Positive	Negative
M. D.	1:8	Positive	Negative
E. C.	1:8	Positive	Negative
F. K.	1:8	Positive	Negative
D. H.	1:8	Positive	Negative
M. B.	1:16	Negative	Negative
D. B.	1:16	Positive	Negative
J. B.	1:16	Positive	Negative
D. R.	1:16	Positive	Negative
C. L.	1:16	Positive	Negative
J. G.	1:16	Positive	Negative
M. H.	1:16	Positive	Negative
J. P.	1:16	Positive	Negative
V. B.	1:32	Positive	Negative
J. C.	1:128	Positive	Negative

*Cases from the earlier study.

The important observations to be made from Table I are: (1) When only albumin titers are present in the maternal circulation, the Coombs' test is negative in every infant. (2) The infant's Rh type is either positive or negative.

It should be noted, then, that in every case where the antihuman globulin test was negative, the Coombs' test was negative. There was no hemolytic disease of the newborn in this group even though albumin titers ranged as high as 1:128.

The second group (Table II) consisted of 34 mothers. The highest titers recorded at any time in both albumin and antihuman globulin serum is shown. The results on the infants' Rh types and Coombs' tests are also given.

A study of this table reveals that when antihuman globulin antibodies are present in addition to the albumin antibodies the infant's Rh type is positive in every instance. The infant's Coombs' test is negative when antihuman globulin titers are less than 1:8. Infants' Coombs' tests are positive when maternal globulin titers are 1:8 or over. Albumin titers were present in every instance when globulin antibodies were detected.

TABLE II. CASES IN WHICH ANTIHUMAN GLOBULIN ANTIBODIES WERE DEMONSTRABLE IN ADDITION TO ALBUMIN ANTIBODIES

The highest titer of each of these antibodies, found at any time during the prenatal period, is recorded. The infants' Rh types and the results of their Coombs' tests are shown

CASE	HIGHEST ANTI-GLOBULIN TITER	HIGHEST ALBUMIN TITER	INFANT'S Rh TYPE	INFANT'S COOMBS' TEST
M. H.	1:4096	1:8192	Positive	Positive
M. F.	1:512	1:256	Positive	Positive
III*	1:512	1:256	Positive	Positive
R. D.	1:512	1:64	Stillborn at 26 weeks	
E. P.	1:512	1:512	Positive	Positive
B. F.	1:256	1:32	Positive	Positive
T. E.	1:128	1:64	Positive	Positive
G. R.	1:128	1:32	Positive	Positive
IV*	1:128	1:256	Hydrops fetalis	
W. M.	1:64	1:4	Stillborn at 24 weeks	
M. N.	1:64	1:32	Positive	Positive
E. Mc.	1:64	1:16	Positive	Positive
M. S.	1:64	1:64	Positive	Positive
V*	1:64	1:64	Positive	Positive
VI*	1:64	1:32	Positive	Positive
A. S.	1:32	1:16	Positive	Positive
E. O.	1:32	1:16	Positive	Positive
J. S.	1:32	1:128	Positive	Positive
B*	1:32	1:32	Positive	Positive
I*	1:32	1:256	Positive	Positive
II*	1:32	1:256	Positive	Positive
H. L.	1:16	1:16	Positive	Positive
E. M.	1:16	1:4	Positive	Positive
M. Mc.	1:16	1:2	Positive	Positive
A*	1:16	1:32	Positive	Positive
VII*	1:16	1:2	Positive	Positive
M. E.	1:8	1:64	Positive	Positive
C. C.	1:4	1:16	Positive	Negative
D. H.	1:4	1:4	Positive	Negative
H. B.	1:4	1:4	Positive	Negative
C*	1:4	1:8	Positive	Negative
B. Mc.	1:4	1:8	Positive	Negative
B. W.	1:4	1:8	Positive	Negative
D*	1:4	1:4	Positive	Negative

*Cases from the earlier study.

Also, in this second group, there were 10 cases (Fig. 1) in which there was a sudden high rise in globulin titer (more than 4 tubes' dilution) in a short period of time (one to two weeks). It should be noted that every infant from this group of mothers was moderately to severely affected by the hemolytic process. This finding was first noted in our original report, but in the combined series it was not as frequent as the first series tended to indicate.

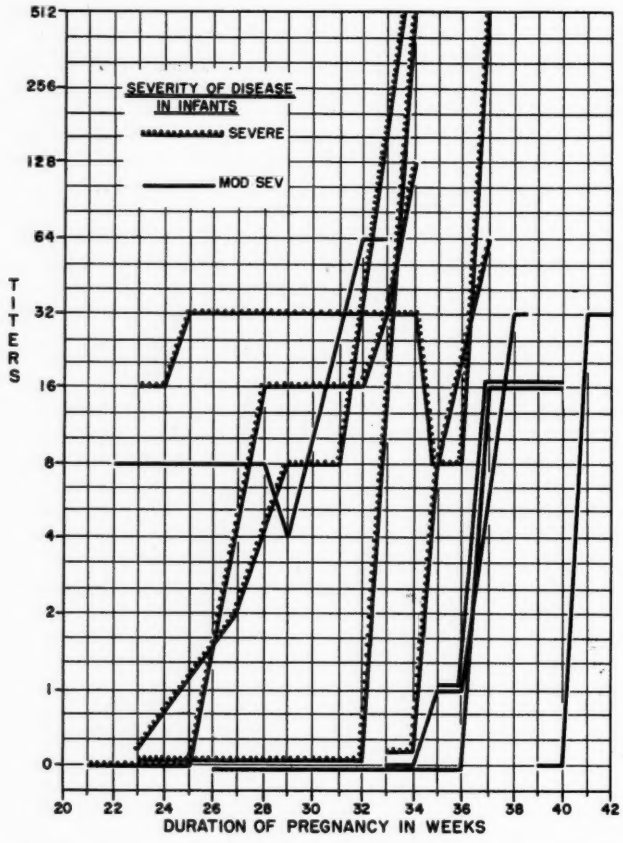

Fig. 1.—Ten cases with a sudden high rise in the antiglobulin titer, showing degree of disease in the infant.

Comment

In our combined study, we have 65 mothers who demonstrated albumin or albumin and antihuman globulin antibodies. (The few that demonstrated saline antibodies were insignificant. Since no information was added by this titer it is not being considered in this report.) Thirty-one mothers developed albumin antibodies only and in every instance the Coombs' test was negative in the infant. We have observed, on the basis of this series, that when only albumin titers are present, the infant will not be affected with hemolytic disease of the newborn. Further, on the basis of albumin titers alone, the infant's Rh type cannot be predicted.

Thirty-four mothers developed antihuman globulin titers in addition to albumin titers. In every instance their infants were Rh positive. In every case where the antihuman globulin titer was 1:8 or over, the Coombs' test on the infant was also positive. The degree of hemolytic disease varied; however, the correlation between degree of disease and height of antihuman globulin titer was good. The higher the titer the more severe tended to be the degree of disease in the infant. On the basis of our present study with the antihuman globulin serum, we can predict an Rh-positive infant and a Coombs'-positive infant if the titers are higher than 1:8. In the cases where the antihuman globulin titer was less than 1:8, the Coombs' test was negative in each of the infants. This small number is by no means conclusive but it seems to indicate that when globulin titers are low the infant's Rh type will be positive, but the Coombs' test will be negative.

In 10 cases where the antihuman globulin titer rose rapidly in a short period of time (one to two weeks) by 4 or more tubes' dilution the infant in every instance was moderately or severely affected by the hemolytic process. The earlier in the pregnancy that the jump occurred, the more severe was the disease.

We do not feel that albumin antibody determinations should be discontinued. Usually they precede, and always they have been associated with, antihuman globulin antibodies. Since antibody determination in albumin is a more common procedure, it can be used as a screening test to indicate the presence of antibodies. However, the significant antibodies in the etiology of hemolytic disease of the newborn are apparently better detected by the antihuman globulin test. The question arises as to whether albumin actually determines any significant antibody, or does it merely indicate some type of precursor? Is it possible that albumin-demonstrated antibodies do not pass the placental barrier while the globulin-demonstrated antibodies do?

We have not yet had a case where a mother has shown previous antihuman globulin titers and delivered an Rh-negative infant. Should this contingency arise, some change may have to be made in our present concepts.

Conclusions

1. Absence of antiglobulin antibodies in the material circulation, despite the presence of albumin or saline antibodies, will result in a negative Coombs' test in the infant. The infant's Rh type cannot be predicted.

2. Presence of antiglobulin antibodies has resulted in an Rh-positive infant in every instance.

3. Antiglobulin antibody titers less than 1:8 had resulted in a negative Coombs' test in the infant.

4. Antiglobulin antibody titers over 1:8 have always resulted in a positive Coombs' test in the infant and a variable degree of disease in the infant.

5. A sudden sharp rise of antiglobulin antibody titer of 4 or more tubes' dilution in a one- to two-week period has always resulted in a moderately to severely affected infant. The earlier this rise, the greater appears to be the risk to the infant.

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IS THE DANGER OF VAGINAL EXAMINATION IN LABOR OVERESTIMATED?

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THE use of rectal examinations in labor was introduced independently by Emil Ries[1] and Krönig[2] in 1894. This valuable technique was slow to reach this country and it was not until the nineteen twenties that its adoption in the United States became widespread. During the past twenty-five years, however, not only has it become the standard method of following cases of labor, but the pendulum has swung so far in its favor that a certain culpability has attached itself to the performance of vaginal examinations. This attitude, based on the fear that vaginal examinations are much more likely to introduce infection than the rectal technique, has been so stressed that reluctance to examine a patient per vaginam has occasionally resulted in diagnostic and prognostic errors.

There can be no question of the greater convenience and timesaving advantages of rectal examination; and in the great majority of cases the information obtained is clear-cut and dependable. But, over the years, the chief advantage which has been claimed for the rectal procedure has been that it is innocuous from the viewpoint of introducing infection in contrast to the vaginal method which has been regarded as imposing very real danger in this respect, especially if multiple vaginal examinations are performed. Has the danger of vaginal examination in labor been exaggerated? This question was studied 30 years ago by Ralph A. Reis[3] who showed that under conditions existing at that time the incidence of puerperal febrility was the same whether vaginal or rectal examinations were done But despite this report a widespread reluctance to perform vaginal examinations in labor, especially multiple vaginal examinations, has persisted and in view of this circumstance, it has seemed worth while to repeat the study of Reis on two modern series of cases in which special care was taken that the two groups were identical in every way except for the type of examination used.

From March 1, 1952, through June 30, 1952, there were 711 deliveries on the Obstetrical Service of the United States Army Hospital, Fort Benning, Ga. Fourteen of these cases were excluded from the present study because 10 were delivered by cesarean section and 4 went through labor without either rectal or vaginal examination. In April and June, all patients were examined by the vaginal route only, 364 in all; whereas in March and May, all patients were examined by the rectal technique only, 333 in all. In both series the percentage of examinations performed by physicians and nurses was equal. The vaginal

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procedure was done in the labor bed. The perineum was first cleansed with sterile water; sterile gloves were used. Rectal examinations were done in the usual manner.

In a study of this kind it is of paramount importance that there be no selection of cases and that the two series be identical in every respect except for the use of vaginal examinations in one group and of rectal examinations in the other. The first four tables are designed to demonstrate that the two series of cases were comparable in every respect other than in the method of examination.

TABLE I. ANALYSIS OF 697 CASES DELIVERED AT THE U. S. ARMY HOSPITAL, FORT BENNING, GA., FROM MARCH 1, 1952, THROUGH JUNE 30, 1952

	VAGINAL EXAMINATION		RECTAL EXAMINATION	
	CASES	PERCENTAGE	CASES	PERCENTAGE
A. Race.—				
White	340	93	309	93
Negro	24	7	24	7
B. Parity.—				
Primiparas	169	46	171	51
Multiparas	195	54	162	49
C. Age (Years).—				
13-16	6	2	6	2
17-20	77	21	97	29.1
21-24	143	39	102	31
25-28	82	22.5	69	21
29-32	37	10	48	14
33-36	12	3	8	2
37-40	5	1	2	0.6
41 plus	2	0.5	1	0.3
D. Pelvis.—				
Normal	359	99	329	99
Contracted	5	1	4	1
E. Maternal Complications in Pregnancy.—			300	
None	331			
Heart disease	5		3	
Pulmonary disease	1		3	
Renal disease	5		6	
Anemia	10		11	
Vascular disease	2		0	
Operations during pregnancy	0		2	
Syphilis, treated	4		4	
Liver disease	2		0	
Measles, mumps during pregnancy	2		0	
Diabetes mellitus	0		1	
Epilepsy	1		3	
Thyroid disease	1		0	

Thus, if Table I be studied it will be seen that the series of parturients followed by vaginal examination, and the series followed by rectal examination were very similar in respect to race, parity, age, pelvis, and maternal complications in the course of pregnancy. In like manner, Table II shows that the duration of the first, second, and third stages of labor was of the same general order, while in those patients whose membranes ruptured prematurely the interval between this accident and the onset of labor was approximately the same in

the two groups. Table III re-emphasizes the similarity of the two groups in respect to the incidence of operative delivery and perineal status. Finally, it may be observed as an over-all comment that the obstetrical clientele at Fort Benning, Ga., during this period was made up chiefly of healthy young women.

TABLE II. DURATION OF THE STAGES OF LABOR AND THE INTERVAL BETWEEN RUPTURE OF MEMBRANES AND ONSET OF LABOR

	VAGINAL EXAMINATION		RECTAL EXAMINATION	
	CASES	PERCENTAGE	CASES	PERCENTAGE
A. Duration of First Stage (Hours.)—				
Unknown	34	9.5	23	7
0-5	116	32	109	33
6-11	146	40	126	38
12-17	52	14	54	16
18-23	11	3	12	3.5
24-29	2	0.6	2	0.6
30-35	1	0.3	4	1
36 plus	2	0.6	3	0.9
B. Duration of Second Stage (Minutes).—				
Unknown	20	5	9	3
0-20	158	44	152	47
21-40	110	30	87	26
41-60	34	9	32	9
61-80	13	3.5	14	4
81-100	12	3	5	1
101-120	5	1	7	2
121-140	3	0.8	9	3
141-160	2	0.5	3	0.9
161-180	1	0.2	2	0.6
181-200	0	0	5	1.5
201 plus	6	1	8	2
C. Duration of Third Stage (Minutes).—				
Unknown	0	0	2	0.6
0-30	359	98.6	321	96.1
31-60	3	0.8	9	3
61-90	2	0.6	1	0.3
91-120	0	0	0	0
Manual removal placenta	9	2	19	5
Spontaneous delivery placenta	355	98	314	95
D. Interval Between Rupture of the Membranes and the Onset of Labor (Hours).—				
Unknown	8	2	6	2
0-6	337	93.2	309	92.7
7-13	1	0.2	4	1.2
14-20	3	0.8	1	0.3
21-27	6	1.6	4	1.2
28-34	1	2	0	0
35-41	2	0.5	2	0.6
42-48	2	0.5	4	1.2
49 plus	4	1	3	1

Of utmost importance, of course, in any study of this sort is the number of examinations carried out in each series. This is shown in Chart 1 where it may be observed that the number of patients having any given number of examinations in each series was almost identical when the number of examina-

tions was two, three, or four, but showed some differences in the other groups because the number of patients in each category was smaller. Since most patients, however, had either two, three, or four examinations, since the patients having either five or six examinations were identical in both groups, and since the difference shown in patients having but a single examination happened to show a higher figure in the vaginal series, it can be concluded that the number of vaginal and rectal examinations done in each series was an altogether valid test of the role of vaginal examination in causing puerperal infection.

TABLE III. TYPE OF DELIVERY AND PERINEAL STATUS

	VAGINAL EXAMINATION		RECTAL EXAMINATION	
	CASES	PERCENTAGE	CASES	PERCENTAGE
A. Type of Delivery.—				
Spontaneous	191	52	163	50
Low forceps	139	38.8	143	42
Midforceps	10	2	4	1
Breech delivery	23	7	20	6
Version and extraction	1	0.2	3	1
B. Perineal Status.—				
Intact	68	19	73	22
Episiotomy	256	71	221	67
1st degree laceration	26	7	24	7
2nd degree laceration	9	2	11	3
3rd degree laceration	5	1	4	1

TABLE IV. POSTPARTUM COMPLICATIONS

	VAGINAL EXAMINATION		RECTAL EXAMINATION	
	CASES	PERCENTAGE	CASES	PERCENTAGE
None	249	81	269	81
Pyelitis	3	0.8	4	1.2
Urinary retention	3	0.8	2	0.6
Endometritis (see Chart 2)	17	4.6	18	5.7
Breast infection	3	0.8	1	0.3
Upper respiratory infection with fever	1	0.2	2	0.6
Gangrene, perineal	0	0	1	0.6

TABLE V. FETAL OUTCOME

	VAGINAL EXAMINATION		RECTAL EXAMINATION	
A. Immature.—				
Cases	4		5	
Deaths	4		5	
B. Premature.—				
Cases	26		31	
Deaths	10		9	
Weight:	CASES	DEATHS	CASES	DEATHS
1,000-1,500 grams	6	3	5	4
1,501-2,000 grams	10	5	12	3
2,001-2,499 grams	10	2	14	2
C. Mature.—				
Cases	344		315	
Deaths	1		1	

The results of this comparative study of vaginal and rectal examinations in respect to their causing puerperal febrility and, by the same token, puerperal infection, are shown in Chart 2. Here it may be seen that the incidence

of febrility at different levels is practically identical in the two series. This chart shows the highest temperature reached during the patient's hospital stay. Elevations to 100° F. or above were present in 10.3 per cent of the patients examined vaginally and 10.4 of those examined rectally. The similarity between the two series in respect to febrility is quite striking and this appears to be the meat of the problem. Table IV shows the incidence of various postpartum complications including endometritis.

CHART 1
NUMBER OF EXAMINATIONS

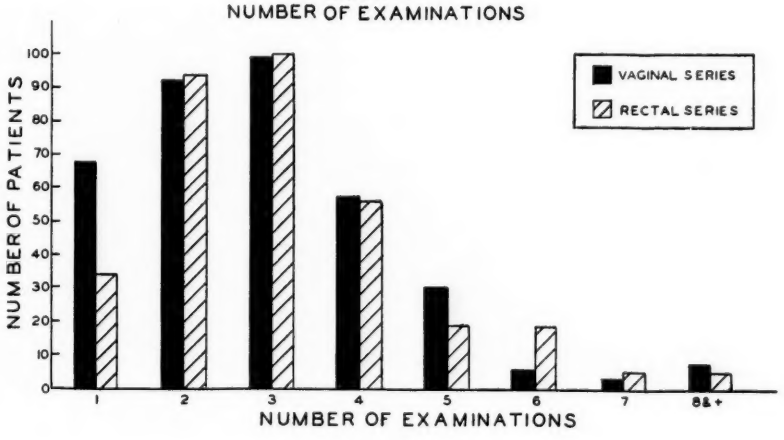
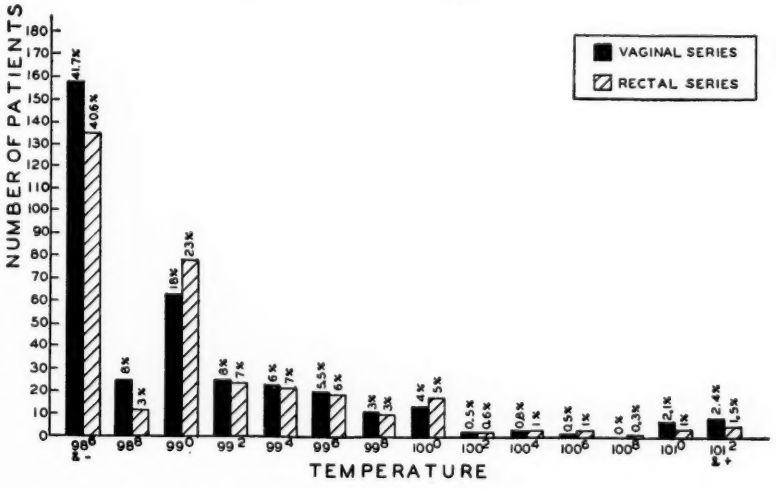


CHART 2
TEMPERATURE RECORD



Other items that might conceivably have a bearing on the validity of this study are as follows: Penicillin, Aureomycin, streptomycin, and other antibiotics were given to 51 patients (11 per cent) who received vaginal examination and to 70 patients (21 per cent) who were examined via the rectal route. The low incidence of febrility in the patients examined vaginally was not therefore the result of antibiotic administration, because the incidence of such therapy was lower in the vaginal series than in the rectal group. Prolonged

hospitalization, that is, more than four days in the case of multiparas and five days in the case of primiparas was negligible in both series. There were 14 such cases in the rectal series and 12 in the vaginal group. As may be seen in Table V the fetal outcome was almost identical in both series. There was no fetal or neonatal death in the vaginal series that could be attributed to the use of the vaginal procedure. No evidence of infection was present in infants who died or those who survived. This statement is based on an autopsy incidence that was very close to 100 per cent.

Summary

The purpose of this paper is not to advocate the routine use of vaginal examinations in labor, nor is it intended to belittle the advantages of the rectal procedure from the viewpoint of convenience. Its main aim is to point out that the danger of vaginal examination is exaggerated.

Three hundred sixty-four patients were subjected to vaginal examinations in labor and a corresponding number were followed rectally. The incidence of pyrexia, postpartum complications, and duration of hospital stay were almost identical in the two series. Nor was perinatal morbidity or mortality affected in any way.

When rectal examination is unsatisfactory and/or the findings are questionable, the vaginal approach can be employed even on multiple occasions without fear that a dangerous procedure is being employed. It can be used with relative impunity not only for clinical purposes but also advantageously for the teaching of medical students and interns.

I wish to express my appreciation to Colonel J. S. Zelenik for his invaluable aid in the preparation of this paper.

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ROUTINE MANUAL REMOVAL OF THE PLACENTA*

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DESPITE the dramatic decrease in the number of maternal deaths in the last twenty years, hemorrhage still remains one of the three most important causes of death (Table I).

TABLE I. MATERNAL MORTALITY IN THE UNITED STATES, RATE PER 10,000 LIVE BIRTHS

	1933	1946	1949
Total rate	60	15.7	9
Toxemia	14.8	3.8 (24.2 per cent)	2.9 (32.2 per cent)
Infection	24.0	5.4 (34.4 per cent)	1.4 (15.5 per cent)
Hemorrhage	20.5	4.8 (30.1 per cent)	1.5 (16.6 per cent)

Postpartum hemorrhage is the most common cause of blood loss in obstetrics, accounting for approximately 25 per cent of deaths in the obstetrical hemorrhage group, according to Eastman.[1] In California in 1949, there were 163 maternal deaths (a rate of 7 per 10,000 live births). Of these, postpartum hemorrhage was listed as the cause of death in 15 cases, or 9.2 per cent of all the deaths. In San Diego County in 1951, of 9 maternal deaths which occurred, 3 were due to hemorrhage.

Postpartum hemorrhage is usually the result of atony of the uterus, lacerations of the birth canal, or retention of placental or membrane fragments. Eastman[1] states that atony is the cause in 90 per cent of cases and that retention of placental fragments is an uncommon etiology, yet, in California in 1949, 2 deaths were so recorded.

Stander,[2] and Douglas and Davis[3] have shown that the greater the blood loss, the higher the incidence of puerperal sepsis. It appears logical that much of the morbidity and even the high mortality rate which has been ascribed to sepsis alone has actually been secondary to excessive blood loss.

Postpartum hemorrhage has been defined as bleeding in excess of 500 c.c. during the first twenty-four hours after birth. The incidence of blood loss exceeding this amount is statistically high as shown by Table II taken from Eastman's[1] textbook.

TABLE II. INCIDENCE OF POSTPARTUM HEMORRHAGE*

500 c.c.	10 per cent
600 c.c.	5 per cent to 6 per cent
1,000 c.c.	1.5 per cent
1,500 c.c.	0.3 per cent
2,000 c.c.	0.07 per cent

*Taken from Eastman.[1]

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In an attempt to effect reduction in the high incidence of excessive bleeding, many different methods of handling the third stage of labor have been suggested. The placenta has been delivered spontaneously, by traction on the cord, by pressure on the contracted uterus above it, by the Credé method, which is being used less frequently today because it is traumatic, and by the administration of oxytocics to facilitate its separation and delivery. Finally, manual extraction of the placenta has remained the last resort when all other means have failed.

Usual indications for manual removal have been postpartum hemorrhage, prolonged labor, operative delivery, prematurity, maceration of the fetus, multiple pregnancies, hydramnios, infection of the amniotic sac, previous manual removal of the placenta, the use of oxytocics, and parity.

TABLE III. INCIDENCE AND MORBIDITY

REPORTED BY	TOTAL DELIVERIES	TOTAL MANUAL REMOVALS	PERCENTAGE MATERNAL DEATHS	PERCENTAGE OF MATERNAL MORBIDITY
Odell and Hovis,[4] Iowa City, 1943	15,824	70	2.8	----
Schwartz and Richards,[5] Bellevue Hospital, 1943	8,902	74	2.7	43.1
Peckham,[6] Johns Hopkins Hospital, 1935	From 1896 to 1933	186	10.76 if operative delivery	48.48
			4.48 if spontaneous	10.45
Block,[7] 1937	50,545	386	3.6	----
Halsey,[8] New York Lying-In Hospital, 1952	53,645	377	0.8	25.1
DeVoe and Hunt,[9] Mayo Clinic, 1947	6,750	98	--	4.5
Mayes,[10] Methodist Hospital, Brooklyn, 1947	22,246	260	0.4	10.8
Cacciarelli,[11] Newark, N. J., 1949	Routine	1,625	0	0
Sewall and Coulton,[12] 1946	------	45	0	2.2 corrected to 0

The appalling number of deaths and the morbidity shown in Table III when manual removal has been performed as a last resort appear to be the result of procrastination and repeated attempts at traumatic delivery of the placenta with excessive blood loss so that the patient had arrived at a precarious state before the procedure was carried out. Many authors agree (Dieckmann,[13] Mayes,[10] Cacciarelli[11]) that the immediate early removal of the placenta manually is a harmless procedure when properly done.

The cases reported in this paper comprise 977 private patients from whom I delivered the placenta manually as a routine procedure. Several hundred additional cases were similarly handled prior to this series, and impressions gained from them have been confirmed statistically in this series. The procedure was carried out on all patients delivered vaginally regardless of type of delivery, complications of pregnancy, duration and type of labor, or anesthesia.

In order to show that these were not selected patients, major medical complications which made 67 of the 977 patients potentially poor risks are listed in Table IV.

TABLE IV. MAJOR COMPLICATIONS OF PREGNANCY

Toxemia	21
Tuberculosis	9
Asthma	7
Chronic pyelitis	4
Heart disease	4
Diabetes	3
Bleeding	2
Syphilis	2
Chronic undulant fever	1
Major depression	1
Chest tumor	1
Rheumatoid arthritis	1
Pernicious anemia of pregnancy	1
Multiple kidney stones	1
Bronchiectasis	1
Chronic nephritis	1
Chronic colitis	1
Intraepithelial carcinoma of cervix	1
Severe obesity	2
Large fibroids	3

The type of anesthesia used is shown by Table V.

TABLE V. TYPE OF ANESTHESIA

Gas	720
Saddle block	229
Ether	16
None	9
Gas and local	1
Pentothal	1
Local	1

The method of delivery is shown by Table VI.

TABLE VI. METHOD OF DELIVERY

Low forceps	756
Spontaneous	155
Midforceps	27
High forceps	3
Version	3
Breech	33
	977
Twins	8
Triplets	1

Episiotomy was performed routinely. Preoperative medication consisted of Seconal, Demerol, and scopolamine in the great majority of cases. High forceps were used on 2 patients with prolapsed cords at complete dilatation and on 1 with massive hemorrhage from a complete separation of the placenta at the end of the first stage of labor.

Table VII lists 22 placental complications which were observed during labor, and these are listed because they contributed to excessive blood loss at the end of labor and in the postpartum period in 6 patients.

The method of handling the third stage of labor is as follows. Intravenous Ergotrate is given at the time of the delivery of the anterior shoulder except in patients who have had saddle block, and in them the intramuscular

route is used. After completion of delivery of the infant, the cord is ligated when it stops pulsating unless the patient begins to bleed at an excessive rate in which case the cord is stripped, immediately ligated, and cut. The vulva and the vagina are then washed off with antiseptic and the hand placed into the uterus, the placenta separated from the wall of the uterus, and the placenta and membranes withdrawn in one piece if possible. It is then advisable to make a further exploration of the uterus to be certain that all of the placenta and membranes have been removed. If the placenta is found to have separated and to be in the lower segment or vagina, it is removed and the uterus is explored. Frequently large pieces of membranes are densely adherent to the uterus, do not separate readily, and tear off during the delivery of the placenta thus necessitating their removal by wiping them from the uterine wall with the gloved hand covered with sterile gauze. Similar adherence of the membranes is frequently seen at the time of cesarean section when one has to pull away forcibly the membranes from the lower uterine segment. Careful inspection of the originally removed placenta and membranes may show no defect even though we have just removed a large piece of membrane or placenta from the uterus. I believe that to rely on the inspection of the placenta following its delivery by the usual means may be deceiving because of this experience. Antibiotics are not used routinely, being administered only when indicated by postpartum complications. No uterus is packed.

TABLE VII. PLACENTA COMPLICATIONS

		EXCESSIVE BLEEDING
Abruptio Placentae.—		
Complete, at end of labor, stillborn	1	1
Partial, labor, all living babies	10	–
Partial, labor, 6 months, all stillborn	3	2
Placenta Previa.—		
Central, both at 7 months, with stillborn babies	2	2
Partial, both at 6 months, with stillborn babies	2	1
Marginal, term baby, living	1	–
Degeneration of Placenta, No Toxemia.—		
Antepartum death near term	3	–
Total	22	6

One must learn by experience to recognize the internal configuration of a normal postpartum uterus which is often corrugated and irregular in shape and may have a shaggy decidua. Also the difference in thickness of the muscular wall of various areas of the uterus may be confusing so that the obstetrician may feel that lacerations are present when they do not exist. This is especially true at the junction of the upper and lower segments and at the placental site if this happens to be in the cornual area. One must not yield to the temptation to dig into the wall of the uterus with the fingers to remove shaggy bits of decidua. Submucous fibroids should be left undisturbed.

The average blood loss in the series was 150 c.c. The estimation of blood loss was approximate and was made by previously measuring the bowls into which the blood and placenta were received at the various hospitals so

that my estimations when checked were correct within 50 c.c. As shown in Table VIII, I have reported patients who lost as little as 300 c.c. of blood. Because of the smaller than average blood loss following the early manual removal of the placenta, I have become very much concerned over blood loss and feel that the accepted standard of pastpartum hemorrhage—500 c.c.—may be excessive. It would seem that the general condition of the patient prior to and during labor, the rate of blood loss, and its immediate effect upon pulse and blood pressure are far more important than the actual number of cubic centimeters lost. Unless it is measured, blood loss may be underestimated by hundreds of cubic centimeters so that the patient's resistance is lowered and followed by a supposedly unexplained morbidity. More careful observation of blood loss and its immediate replacement should reduce this morbidity.

TABLE VIII. ABNORMAL BLOOD LOSS (18 CASES)

	BLOOD LOSS	BLOOD GIVEN	INTRAVENOUS FLUIDS
A. Atony of uterus	300 c.c.	--------	1,000 c.c.
	300 c.c.	500 c.c.	1,000 c.c.
	350 c.c.	--------	--------
	400 c.c.	500 c.c.	--------
	400 c.c.	--------	500 c.c.
	400 c.c.	--------	1,000 c.c.
	500 c.c.	1,000 c.c	1,000 c.c.
	500 c.c.	--------	1,000 c.c.
	500 c.c.	500 c.c.	1,000 c.c. (reaction to spinal)
B. Separation of placenta	400 c.c.	500 c.c.	1,000 c.c.
Placenta previa	750 c.c.	1,000 c.c	--------
	750 c.c.	1,000 c.c	500 c.c.
	400 c.c.	500 c.c.	500 c.c.
	400 c.c.	--------	--------
	750 c.c.	1,000 c.c	--------
C. Cervical laceration	400 c.c.	--------	1,000 c.c.
	500 c.c.	500 c.c.	1,000 c.c. (varicosities of cervix)
Bleeding episiotomy	1,400 c.c.	1,500 c.c.	1,000 c.c.

The incidence of abnormal blood loss in this series of 977 patients is 1.83 per cent from all causes. Eight of the patients reported in Table VIII bled from atony of the uterus alone, but undoubtedly the postpartum bleeding which occurred in the patients with separation of the placenta and placenta previa was also due to atony, perhaps of the placental site, which would mean that in this series 15 of the 18 patients who bled did so because of atony, which is 83 per cent and agrees with the usual statement that 90 per cent of postpartum hemorrhage is due to atony.

No patient bled from retained fragments of placenta or membranes.

There were 5 other patients who were given blood transfusions of 500 c.c. for reasons other than hemorrhage, such as severe anemia during pregnancy, repeated small episodes of bleeding during pregnancy, from placenta previas without hemorrhage at or following labor, and in one case following a difficult delivery with a prolonged anesthesia.

There were no maternal deaths.

Total morbidity was 2.25 per cent from all causes. Eleven patients developed mild uterine infections. The temperature was elevated to 100.4° F. or

above for three days in the longest febrile case. All of these patients left the hospital by the fifth postpartum day with no abnormal sequelae. The remaining fevers were due to obvious cases of breast infections, pyelitis, respiratory infections (during one of the "flu" epidemics), or transfusion reactions. If only the uterine infections (11) are considered, morbidities which could be related to the method of delivery of the placenta, it appears that the figure 1.12 per cent is not excessive. I have failed completely to compare these figures with usual puerperal morbidity because morbidity statistics which are reliable are not readily available. Many hospitals do not record them, few people publish them, and the methods and times of taking temperatures vary greatly between the various institutions which alters the morbidity rate.

TABLE IX. MORBIDITY

MORBIDITY CAUSES	NUMBER OF CASES
Uterine infection	11—1.12 per cent
Infected breasts	3
Pyelitis	3
Respiratory infections	3
Transfusion reactions	2
Total	22—2.25 per cent

There were certain unexpected pathological findings discoverable only by manual removal of the placenta or by exploration of the uterus. These consisted of four densely adherent placentas (but no true placenta accreta), three pedunculated submucous fibroids, five double uteri of various types (usually containing long septa), and one twin pregnancy in which one twin had died at approximately three and one-half months and the remaining twin had been carried to term.

Many patients have called to my attention the fact that there were less odor and a smaller volume of lochia than following previous deliveries. Observation has convinced me that this is true. My explanation is that by removing the placenta and membranes completely, I have not left small pieces of secundines in the uterus to undergo degeneration, putrefaction, and infection as in the past.

I did not find it true that manual removal is followed more frequently by late postpartum hemorrhage as no case of hemorrhage was reported in this series. One patient who had been known to have fibroids for eleven years prior to delivery had a hemorrhage on the twelfth postpartum day from degeneration of a fibroid which required hysterectomy as curettage failed to control the bleeding.

It has been reported that manual removal of the placenta is frequently followed by sterility. I have found no evidence to support this theory inasmuch as I have delivered many of these patients more than once, doing a manual removal each time. I believe the sterility which has been reported was due to the tumultuous postpartum course which followed manual removal in seriously ill patients.

This series of manual removals of the placenta was done with no thought of indulging in meddlesome obstetrics, but rather to confirm the conviction

that an empty uterus is not likely to bleed or become infected, and to determine if the elective manual removal of the placenta is a safe procedure when carried out promptly, proficiently, and before the patient has been traumatized by ill-advised methods of delivery, or has bled into a precarious state. The low incidence of postpartum bleeding, the absence of any deaths, and the low percentage of morbidity convince me that it is a safe procedure. Because of the experience reported in this paper, I feel that if more obstetricians would adopt the procedure of early manual removal of the placenta if it does not separate and deliver immediately, or if the patient is beginning to bleed at an excessive rate, we could effect a considerable reduction in puerperal morbidity, and that the maternal mortality rate from hemorrhage would be reduced.

Summary

The study of 977 patients from whom the placentas had been removed manually as a routine elective procedure is reported. The incidence of postpartum hemorrhage of 1.83 per cent and puerperal morbidity of 2.25 per cent is low. The procedure has allowed the obstetrician to control the third stage of labor, to assure himself that the placenta and membranes have been removed completely, and to determine the presence of unsuspected intrauterine pathology. The *immediate* manual removal of the placenta should reduce the previously high morbidity and mortality rate which has been associated with this procedure in the past when it was delayed until the patient was in a serious condition. It is not suggested that routine manual removal of the placenta be carried out on all obstetrical patients, but in view of the fact that the procedure seems innocuous when done promptly while the patient is still in good condition, it should be performed immediately when the placenta does not separate and deliver at the expected time, or if an abnormal rate of blood flow begins. Proficiency in the performance of manual removal of the placenta should be one of the skills of the adequately trained obstetrician.

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TWO CASES OF MÜLLERIAN CARCINOSARCOMA

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INSTANCES of tumors presenting the histological picture of carcinoma and sarcoma in combination are not common.[1] While this combination has been reported occasionally, many authorities[2, 3, 4, 7] question such an interpretation and designate these tumors as undifferentiated carcinomas. It is our belief that such tumors may occur and two instances are herewith reported.

In one case the tumor arose in the endometrium of the corpus uteri, while the other arose in an ovarian cyst which grossly and microscopically appeared to be of endometrial origin. The extreme rarity of a malignant tumor arising in ovarian endometriosis is recognized[5] but we believe that we have satisfied the criteria of Sampson[6] for proof of such an origin in our second case. Its striking gross and microscopic similarity to the first case would appear to support this interpretation further.

Case 1.—Mrs. M. C., aged 61, was admitted to the Montreal General Hospital, complaining of urinary frequency, stress incontinence, recurrent abdominal pain, and constant vaginal spotting for the preceding four months. The primary symptoms of urinary character were not accompanied by any discomfort but more recently there had been recurrent attacks of pain and a gradual enlargement of the abdomen. The bleeding had never been excessive. Her past history was negative. The onset of menstruation had been at the age of 12 years, with a thirty-day interval and a duration of five days. An uneventful menopause had occurred at the age of 50 years. She had been married for thirty-five years and had never been pregnant. There had been no recent change in weight.

On physical examination the temperature was 99° F., the pulse rate was 100 per minute, and the blood pressure 116/76. The heart and lungs were normal. The lower abdomen was enlarged by a rounded mass arising from the pelvis to within one inch of the umbilicus. This mass was hard, mobile and nontender. There was no evidence of free fluid in the abdomen. Pelvic examination showed a normal marital outlet with a normal vagina and cervix. The uterus was replaced by the mass and on the right side near its upper portion there was a firm round extension about the size of an orange.

Urinalysis was negative and blood chemistry findings were normal. The hemoglobin was 78 per cent (Sahli), the red cell count 3.8 million, the white cell count 8,850, and the platelets normal. The coagulogram and prothrombin time were normal.

Laparotomy was advised, the preoperative diagnosis being fibroids of the uterus undergoing degeneration.

When the abdomen was opened the enlarged uterus was immediately observed. The body of the uterus appeared about 4 inches in diameter, and extending from the right side of the fundus was a fibroid mass about 3 inches in diameter. The left adnexa were normal. The right tube was swollen, injected, and adherent to the main tumor mass. The softness

of the uterine mass suggested a fibroid undergoing degeneration. Total hysterectomy and bilateral salpingo-oophorectomy were done. There was no evidence of metastases. Recovery was uneventful.

Following the pathological report of Müllerian carcinosarcoma, a course of deep x-ray therapy, with an estimated tumor dosage of 2,410 r to either side of the pelvis was given. Supportive transfusion of 500 c.c. of blood was given on the twenty-sixth postoperative day, and the patient was discharged on the twenty-ninth day following operation.

This patient died at home within the year from recurrence of the tumor. No autopsy was obtained.

Pathological Report.—

The specimen consisted of a uterus with tubes and ovaries attached. The ovaries and left tube showed no gross or microscopic lesion. The right tube, which was curved back upon itself with its fimbriated end adherent to the right side of the uterus, contained three firm swellings 1.5 cm. in diameter and showed microscopically a chronic inflammatory reaction with ulceration, but no evidence of tumor or endometriosis.

The uterus was globular, somewhat soft to palpation, and enlarged to a diameter of 12 cm. Bulging from the right side was a firm 9 cm. dome. The cervix was normal.

Section of the uterus showed two circumscribed rounded masses covered and separated by a thin layer of uterine muscle. The one on the right side was a typical intramural leiomyoma 9 cm. in diameter. The mass on the left side was the globular uterus containing a soft, friable, spherical tumor mass 11 cm. in diameter and completely obliterating the canal. Although sharply circumscribed, the tumor could not be cleanly separated from the thin coverings of muscle and the cervical canal led directly into it. This tumor was considered to be an endometrial sarcoma.

Histological examination of many sections of the expanding central tumor of the uterus revealed a marked variation in structure. Generally, it was very cellular and scattered throughout were many areas of necrosis. At the periphery the tumor was seen to invade the muscle irregularly, but only for a short distance. It appeared that muscle destruction had closely followed the invasion. In many areas the tumor presented a loosely arranged reticulated structure (Fig. 1) with clear interstices. The cells were large, irregular, and stellate. The cytoplasm was eosinophilic and the processes blend with those of neighboring cells, forming a wide-meshed syncytium. There was a tendency for the cells to arrange themselves into irregular, anastomosing cords or small compact clumps (Fig. 2). The nuclei were rounded, oval, and often indented and varied from 7 to 15 microns in their greatest diameter. Peripherally, the chromatin was condensed while, centrally, it was finely dispersed as threads and granules. Many of the nuclei contained a small nucleolus. One or two mitotic figures per high-power field were present. A reticulum preparation revealed a wide-meshed network of fine reticulum fibrils. They traversed the clear intercellular spaces irregularly and were often folded into skeins and knots. Sometimes they were condensed about the cells but in general they bore no particular relationship to the cells. Thin-walled capillary vessels were fairly numerous. In adjacent areas the cell mass became closely compacted (Fig. 3). The nuclei were the same as those described above. The cytoplasm was less but still frayed out into short processes that fused, forming a close-meshed syncytium. Mitotic figures were more frequent, thin-walled capillary vessels were more numerous, and the reticulum meshwork was correspondingly concentrated. In still more compacted areas, the cells were arranged in parallel rows surrounded by condensed reticulum. In some of the loose-meshed fields, small conglomerations of cells appeared in the syncytium (Fig. 4). These cells were polygonal, the cytoplasm was ill defined and the nuclei were smaller and more hyperchromatic. Single and multiple small nucleoli were frequently present. There was considerable variation in the size and shape of the nuclei and many were elongated or of tear-drop shape. These nests were surrounded by a condensation of reticulum fibrils and we believe that they represented the very early appearance of epithelial structures, i.e., the commencement of endometrial gland formation. In still other fields the cellular groups were more numerous and in them definite cavities appeared (Fig. 5). The cells lining these cavities assumed a

cuboidal or low columnar form. This process of differentiation into glands increased until typical adenocarcinoma became obvious. The stroma itself retained the sarcomatous nature of the earlier illustrations. Reticulum became abundant and condensed about the carcinomatous glands (Fig. 6). The stroma though scanty still remained sarcomatous.

Our interpretation was that the bulk of this tumor was composed of an embryonal Müllerian syncytial sarcoma representing endometrial stroma. In this sarcomatous cell mass we believe we traced a transformation of the embryonal cells into embryonic carcinoma which further differentiated into polygonal, cuboidal, and columnar cell carcinoma and ultimately into clearly recognizable adenocarcinoma representative of endometrial glands.

We designated this tumor Müllerian carcinosarcoma of the uterus.

CASE 2.—Mrs. L. W., aged 47, was admitted to the Montreal General Hospital complaining of lower abdominal pain of two months' duration, irregular menses for six months, and increasing constipation. The pain had first appeared with the menstrual period, two months before, subsiding with the cessation of the flow, and recurring at the next menses to persist at intervals up to the time of admission. It was aching in character and was present in both lower quadrants and the back. Her past history was negative. The onset of menstruation had been at the age of 15 years, with an interval of twenty-eight days and a duration of four to five days. The last menstrual period was 18 days prior to admission. She had been married ten years and had never been pregnant. Although there had been some irregularity of the menses during the past six months, there had been no other evidence of menopausal change. She had had no loss of weight.

On physical examination the temperature, pulse, and respirations were normal and the blood pressure 148/80. The hemoglobin was 76 per cent (Sahli), the red cell count 3.6 million, and the urinalysis negative. The heart and lungs were negative. The abdomen was rounded, with a dull nontender mass arising from the left side of the pelvis well up above the level of the umbilicus. Pelvic examination showed normal external genitals with a small clean cervix in normal position. The uterus was irregularly enlarged by several small fibroids with a large firm mass lying above the uterus on the left side and extending down into the left lateral fornix and behind the cervix. The uterus was somewhat fixed and there was an extension of the mass in the cul-de-sac into the right lateral fornix. A diagnosis of multiple fibroids with possible endometriosis was made and laparotomy was advised.

At operation the omentum was adherent to the left adnexa and to a large fibroid growing in the fundus of the uterus. There were bilateral ovarian chocolate cysts densely adherent to the posterior surface of the uterus, the cul-de-sac, and the left lateral pelvic wall. There was considerable blood pigment on the peritoneum of the vesicouterine pouch and diffuse areas of endometriosis throughout the pelvis. Grossly the pelvis appeared to be the site of multiple uterine fibroids with widespread endometriosis in both ovaries, but in the dissection of the masses the adherence on the left side was even more dense than is usually found in endometriosis. On the right side the appendix was adherent by its terminal third to the pelvic mass, necessitating its removal at the same time. Total hysterectomy, bilateral salpingo-oophorectomy and appendectomy were done. The blood loss was excessive and a moderate degree of shock developed on the table. Transfusion of 500 c.c. of whole blood was given and the postoperative convalescence was uneventful. The patient was discharged from hospital on the fourteenth postoperative day.

This patient was subsequently seen six months later with acute abdominal pain and increasing distention of the abdomen. There was a large mass lying in the left lower quadrant and extending over to the right side. There was also evidence of free fluid. She died at home ten months after the operation from widespread abdominal metastases. No autopsy was obtained.

Pathological Report.—

The specimen consisted of a uterus with attached tubes and ovaries (Fig. 7) and an appendix. The uterus measured 10 by 5 by 4 cm. There was a leiomyoma

Fig. 1.

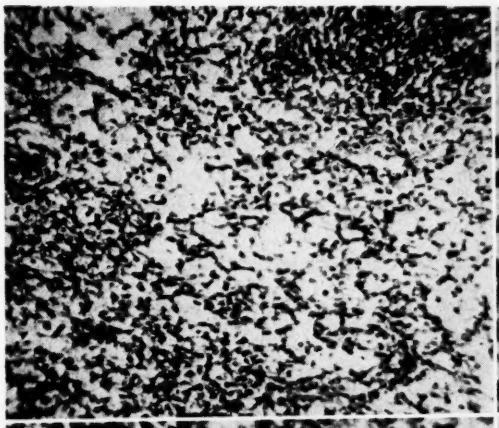

Fig. 2.

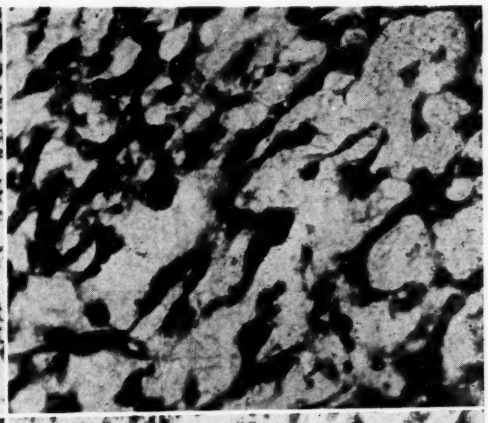

Fig. 3.

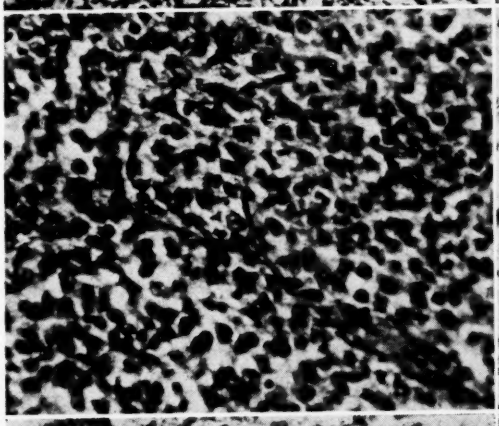

Fig. 4.

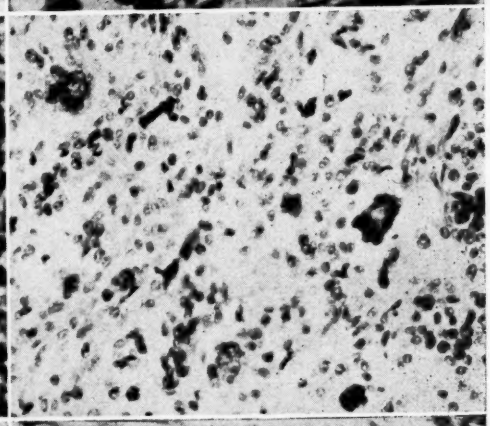

Fig. 5.

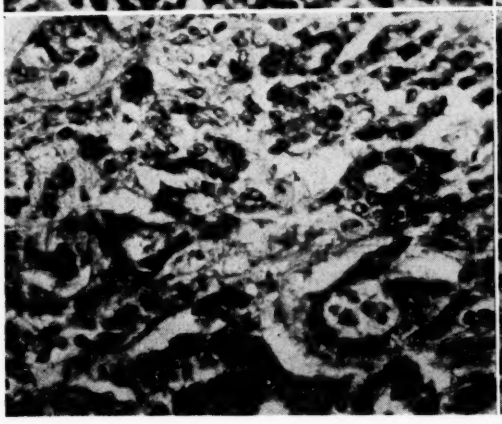

Fig. 6.

Fig. 1.—Area of wide-meshed syncytial sarcoma.

Fig. 2.—Higher-power view of wide-meshed syncytium in which cells are formed into anastomosing syncytial cords.

Fig. 3.—Area of condensed syncytium. Note the delicate vessel traversing the field.

Fig. 4.—Area of wide-meshed syncytium in which are small conglomerations of polygonal cells in one of which a small cavity has formed.

Fig. 5.—Shows the transition from sarcoma above to distinct adenocarcinoma below.

Fig. 6.—Reticulum stain in area of adenocarcinoma. The glands are surrounded by condensations of reticulum fibrils. The stroma is scanty.

6 cm. in diameter in the posterior wall of the fundus and two similar 1 cm. tumors in the anterior wall. The right ovary was represented by a 4 cm. rounded cyst with a thick fibrous wall. The cavity contained fluid "chocolate" and in the wall there was a small corpus hemorrhagicum. The left adnexa consisted of a 10 cm. round cyst firmly adherent to the uterus and over which curved an adherent Fallopian tube. On opening the cyst "chocolate" fluid gushed out, revealing a 9 by 8 by 4 cm. discoid, soft, friable tumor mass attached to the cyst wall by a narrow pedicle. Even with gentle manipulation the tumor mass separated easily and fell out. The surface was somewhat nodular and presented several areas of necrosis and hemorrhage, which were also seen on the cut surface. At its attachment to the cyst wall there was a 3 cm. cyst containing greenish-yellow coagulum. After washing out the major cyst its inner surface was found to be finely trabeculated and its wall opaque and fibrous.

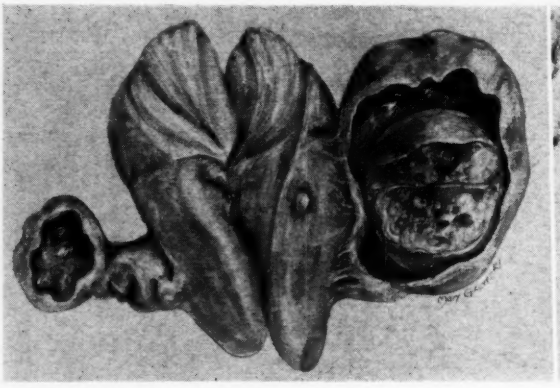

Fig. 7.

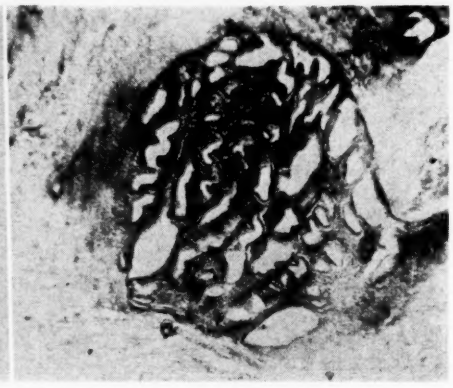

Fig. 8.

Fig. 7.—Gross specimen of uterus, tubes, and ovaries showing the bilateral cystic ovaries, the gross adhesions between the uterus and the larger cyst which contains a soft friable tumor, part of which has been cut away anteriorly. There is a large leiomyoma in the fundus and two small ones in the anterior wall of the uterus.

Fig. 8.—Shows a nest of endometrial tissue from the larger cyst wall where it is adherent to the uterus.

Histological examination of the uterine sections showed no lesion other than the leiomyomas. The wall of the cystic right ovary consisted of a dense fibrous membrane devoid of epithelial lining cells and containing numerous hemosiderin-laden phagocytes, a scattered infiltration with lymphocytes and polymorphonuclear leukocytes, and small nests of elliptical crystals about which there were foreign body giant cells. A small corpus hemorrhagicum was embedded in the wall. Sections of the left tube and surrounding tissues and of the adhesions between the cystic left ovary and the uterus revealed many areas of endometriosis some of which were closely applied to the outer surface of the tube. Sections of the wall of the cystic left ovary were similar to those of the right ovary but with an area of functioning endometriosis in one section (Fig. 8).

Many sections from the discoid tumor mass found within the cyst of the left ovary, like those of the tumor in Case 1, showed a marked variation in structure. Many areas of necrosis and hemorrhage appeared throughout the sections. In the better-preserved tumor, there were areas of loosely arranged stellate cells the processes of which fused one cell with another forming a fairly wide-meshed syncytium (Fig. 9). The cell cytoplasm was eosinophilic or, sometimes, basophilic. The nuclei varied from 5 to 15 microns, mostly 10 to 12 microns in greatest diameter. The nuclear membrane was distinct, the chromatin was condensed peripherally, while centrally it was sparse and in the form of fine threads and granules. A few nuclei were solid and some contained a small single nucleolus. A few mitotic figures were present. This syncytium was supported by a fairly close-meshed reticulum which surrounded single cells and groups of cells. In other areas

the cells were elongated and arranged in ill-defined bundles which did not contain any collagen fibers. In this syncytium larger and more hyperchromatic polygonal cell groups appeared arranged in anastomosing cords and clumps (Fig. 10), taking on the appearance of epithelial cells. In other areas (Fig. 11) there was distinct gland formation in the sarcomatous cell mass. These glands were lined by very irregular epithelial cells, one to several layers thick. In places the lining and stromal cells could not be distinguished one from the other. Reticulum stains (Fig. 12) showed a condensation of reticulum fibrils about the glands.

Fig. 9. Fig. 10.

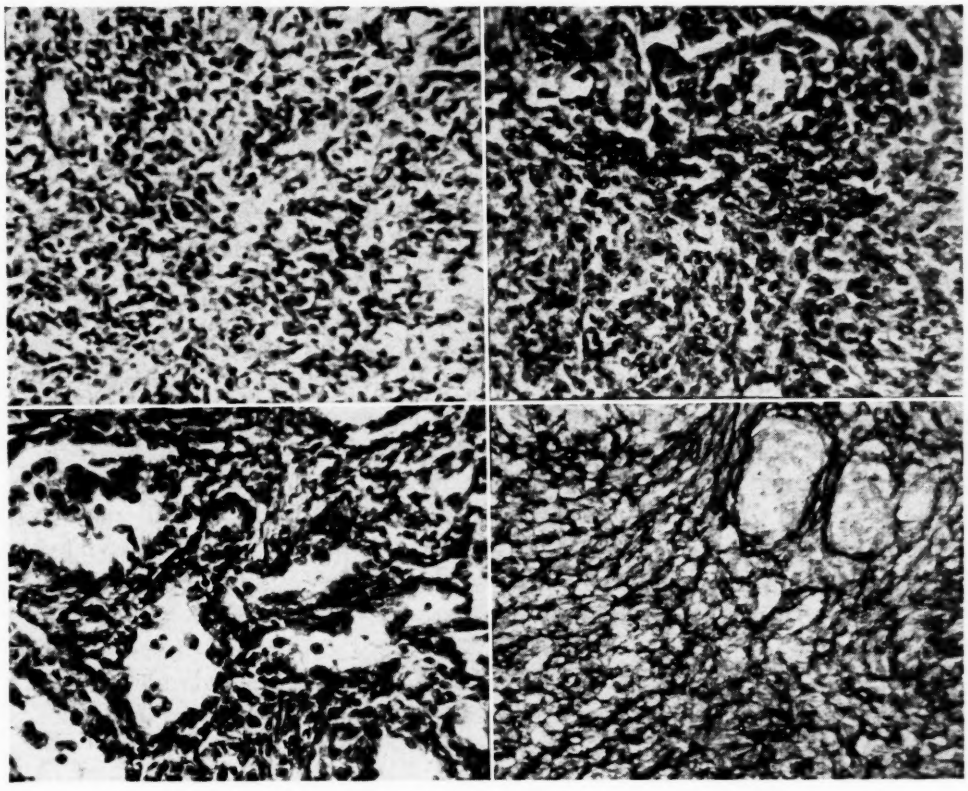

Fig. 11. Fig. 12.

Fig. 9.—Shows an area of loose-meshed syncytial sarcoma from an area in the tumor of the cystic left ovary. Compare this with Fig. 1.

Fig. 10.—Shows, in the lower half, the sarcomatous nature of the tumor and in the upper half the early carcinomatous appearance. Note the transition between the two types of tumor. Compare with Fig. 5.

Fig. 11.—Shows adenocarcinoma in a sarcomatous stroma. In many places the cells lining the spaces are scarcely distinguishable from those of the stroma.

Fig. 12.—Reticulum stain showing the abundant reticulum. Note the large glands in the upper right corner about which there is a condensation of reticulum.

We interpreted this tumor to be a Müllerian carcinosarcoma originating in an endometrial cyst of the left ovary.

Comment

The malignant neoplasms in these cases we maintain are of identical nature, if not quite of identical structure. The differentiation of the adenocarcinoma in the second case is not quite so marked as in the first case. In

both cases the sarcomatous element is in part identical, but in the second case there is a tendency toward the development of bundles of spindle cells not seen in the first case. In Case 1 the tumor occupied the position of the endometrium which it replaced. In Case 2 a similar tumor originated within a cyst of the left ovary. That the cysts in both ovaries of Case 2 were endometrial in origin was attested by their histological and gross appearances and by the presence of marked endometriosis of the pelvic tissues and of the adhesions between the cystic left ovary and the uterus.

Our interpretation of both tumors is that they are fundamentally embryonal Müllerian malignant tumors in which there is a variable degree of differentiation toward endometrial stroma (sarcoma) and endometrial glands (adenocarcinoma). We believe that the development of the carcinoma from the sarcoma is demonstrated in both tumors. In both there are sarcomatous areas without carcinoma, but where carcinoma is present the intervening stroma is still sarcomatous. We believe, therefore, that these tumors are true Müllerian carcinosarcoma in contradistinction to that type of tumor in which there appear to be two separate and distinct entities, sarcoma and carcinoma.

The findings in the two cases presented strengthen the contention that the endometrial stroma and glands are of common origin. Both are sensitive to the same hormones. The mesenchymal nature of Müllerian tissue is attested by the potentialities of endometrial tumors evidenced by the varieties of mesenchymal types of tissue encountered in them.

That the differentiated endometrial tissue is not alone possessed of this Müllerian potentiality is indicated by the development of Müllerian tissue (endometrium) from the stroma of myometrium in adenomyosis and from the connective tissue cells widespread in the subperitoneal tissue of the pelvis and abdomen downward from the umbilicus and the site of Meckel's diverticulum—the field of endometriosis. Furthermore, the occasional appearance, during pregnancy, of islands of decidual reaction in the pelvic and subperitoneal connective tissue of the gut is evidence of this heterotopic Müllerian potentiality.

Summary

Two cases of Müllerian carcinosarcoma are reported, one in the uterus, the other originating in an endometrial cyst of the left ovary.

The nature of the tumors is commented upon.

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CONSERVATIVE TREATMENT OF PLACENTA PREVIA*

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MANY obstetrical teachers say that the only treatment for placenta previa is to transfuse and to perform a cesarean section. We undertook this study of 283 cases of various types of placenta previa primarily to see whether our results bore out this dictum, or whether a more conservative course might be indicated.

This report consists of 283 cases of placenta previa occurring in 70,363 deliveries in the years 1939 to 1950, inclusive, at the Cook County Hospital in Chicago. The incidence of placenta previa was only 0.42 per cent of the total cases, and this was low in comparison with the incidence in other reported series; for instance, that of Davis and associates in December, 1946, was 0.79 per cent.

The age groups of these patients were studied, and the results are tabulated in Table I. As one might expect, the largest proportion of the total, 49 per cent, fell into the group of 19 to 26 years of age. Only 7.1 per cent occurred in the age group of 18 and under, and approximately equal percentages were listed in the 27 to 31, 32 to 35, and 35 years and over groups. Placenta previa is more common in older patients who have had many pregnancies. In this series 30 per cent of the previas occurred in patients who were 32 years of age or older, but this group accounts for considerably less than 30 per cent of our total deliveries.

TABLE I. AGE INCIDENCE

AGE	NUMBER OF CASES	PERCENTAGE OF TOTAL CASES
18 and under	20	7.06
19-22	73	25.7
23-26	66	23.3
27-31	39	13.7
32-35	40	14.1
35 and over	45	15.9

The types of placenta previa were divided into low lying, marginal or partial, and total. The degree of previa was determined by the relation of the placenta to the os at the time of vaginal examination, and/or appearance of placenta post partum. The low-lying is interpreted as being in the lower segment but not directly adjacent to the internal os; the marginal or partial encroaches upon or partially covers the os; and it is total when the whole cervical os is covered by placental tissue. The results of the analysis of the

*Presented at a meeting of the Chicago Gynecological Society, April 17, 1953.

types of placenta previa are seen in Table II. The predominating type by nearly three to one is the marginal or partial placenta previa. This fact should have an important bearing on treatment and should result in a higher number of deliveries through the birth passage.

TABLE II. TYPES OF PLACENTA PREVIA

PERIOD OF GESTATION	LOW	PARTIAL	TOTAL
24-28 weeks	3	30	1
28-32 weeks	17	52	4
32-36 weeks	6	45	12
Over 36 weeks	29	66	18
Total	55	193	35
Per Cent	19.4	68.1	12.3

One may see the various types of treatment employed at different terms of pregnancy in Table III. Conservative treatment with delivery from below should be much more desirable in those quite far from term. Closer to full-term pregnancy, the incidence of cesarean section increased. We think it is important to note the rather low incidence of cesarean section of 19.4 per cent. This is a lower figure than in other series of placenta previa. The most common method of treatment in our series was the use of artificial rupture of the bag of waters in low-lying or partial placenta previa. Next came the use of Braxton Hicks version in similar cases. There is a definite place, too, for the use of the Willett forceps with rupture of the bag of waters. The intraovular bag was used 42 times, but its use has decreased gradually except where it is difficult to grasp a foot to complete a Braxton Hicks version or to use a

TABLE III. TREATMENT

GESTATION	TYPE OF PREVIA	EX-PECT-ANT	MEMBRANES RUPTURED SPONTANE-OUSLY	MEMBRANES RUPTURED ARTI-FICIALLY	INTRA-OVULAR BAG	WILLETT FORCEPS	BRAXTON HICKS VERSION	CESAR-EAN SECTION
24-28 weeks	Low	1		1			1	
	Partial	3		6	5	1	15	
	Total						1*	
28-32 weeks	Low	7	2	2	2		4	
	Partial	3		7	12	6	23	1
	Total						1	3
32-36 weeks	Low	1		4			1	
	Partial		2	20	6	2	6	9
	Total						2*	10
36-40 weeks	Low	6	1	16	2		1	3
	Partial	7	1	28	15	2	2	11
	Total							18
Total		28	6	84	42	11	57	55
Per cent		9.8	2.1	29.6	14.8	3.8	20.1	19.4

*Perforated placenta.

Willett forceps on the head. The Braxton Hicks version was used more frequently when the patient was in jeopardy from hemorrhage and shock and when the cervix was effaced and partially dilated so that a safe version could be done. In most of the cases where this version was done, the fetus was either dead or in desperate condition.

The unusual conditions occurring with placenta previa are noted in Table IV.

TABLE IV. UNUSUAL CONDITIONS WITH PLACENTA PREVIA

TYPE	NUMBER
Breech presentation	18
Shoulder presentation	12
Ruptured uterus	1
Shock	6
Twins	7
Pre-eclampsia	6
Retained placenta	5
Prolapsed cord	19
Postpartum hemorrhage	7
Previous placenta previa	1

Breech presentation occurred 18 times, a percentage of 6.4. Shoulder presentation occurred 12 times. They were associated most often with total placenta previa. There was 1 ruptured uterus in a term pregnancy with a partial placenta previa. The membranes had ruptured and the cervix was 3 cm. dilated. A bag was inserted and was expelled in four hours with incomplete dilatation. A Willett forceps was applied to the head, and spontaneous delivery occurred in two hours followed by postpartum hemorrhage. The uterus was packed, but bleeding persisted, and hysterectomy was done four hours later. A tear was found in the left lateral wall of the uterus, extending upward from the cervix. Only 6 of these patients entered in shock, bearing out the fact that severe hemorrhage is not often present, and these patients may be observed and often treated conservatively. There were 7 cases of twins. Pre-eclampsia was present in 6 cases. Retained placenta occurred 5 times, and there was 1 case of a previous placenta previa.

There were 2 maternal deaths in 283 cases, a mortality of 0.7 per cent. This compares favorably with 0.6 per cent mortality in the Davis series. A brief résumé of these cases follows.

Case Reports

CASE 1.—This was a 30-year-old white gravida vii, para v. Her prenatal course was managed by a private physician. She had bled intermittently for weeks and had been hospitalized twice elsewhere. On admission to Cook County Hospital, her temperature was 104.5° F., pulse 110 and weak, hemoglobin 30 per cent, red cell count 2.1 millions and blood pressure 78/20. The membranes had been ruptured three and one-half days. She had bled heavily from the vagina and had abdominal pain for five days. The uterus was two fingers over the umbilicus and fetal heart tones were questionable.

Blood and plasma were started promptly and within one-half hour the blood pressure rose to 110/70. A sterile vaginal examination was done, revealing a cervix 4 to 5 cm. dilated and the placenta partially covering the os. A foot was easily grasped and a Braxton Hicks version and extraction easily performed upon a fetus of six months' size. The baby was born alive and weighed 1 pound, 15 ounces. Blood transfusion was in progress at the time of delivery, and she received a total of 1,000 c.c. The placenta did not separate, so a manual removal was performed with considerable difficulty. The uterus was packed, and intramuscular Pituitrin and intravenous Ergotrate were given.

Shortly after the patient awakened from the anesthetic, she complained of shortness of breath and abdominal pain. The uterus was firm and no bleeding through the pack was noted. The patient failed to improve and the blood pressure continued to drop despite blood, fluids, stimulants, and oxygen. She died four hours after hospitalization.

Autopsy findings revealed (1) marked generalized anemia, (2) intact postpartum uterus with placental site in the lower uterine segment, (3) edema of all pulmonary lobes, (4) focal thickening of the mitral valve, and (5) marked anemia of all parenchymatous organs. The pathological impression as to the cause of death was recorded as "death due to blood loss."

CASE 2.—The second fatality was that of a 42-year-old gravida xi, para x. She had no prenatal care, and was seven and one-half months pregnant. The patient entered the hospital in labor, the cervix dilated 4 to 5 cm., and almost completely covered by the placenta. She was in shock from the excessive bleeding. Plasma and blood were started and an immediate Braxton Hicks version performed. She received 1,000 c.c. of blood, but died undelivered five hours after admission. More strenuous efforts at delivery were not made because of the seriousness of her condition.

Chance of survival of these 2 patients could have been improved by more generous blood replacement.

The fetal mortality is shown in Tables V and VI.

TABLE V. FETAL OUTCOME

GESTATION	TYPE OF PREVIA	DEAD ON ADMISSION	INTRANATAL DEATH	NEONATAL DEATH	LIVED
24-28 weeks	Low			3	
	Partial	5	17	5	3
	Total	1	1		
28-32 weeks	Low	4	3	2	11
	Partial	11	14	14	12
	Total			4	1
Total under 32 weeks		21	35	28	27
				90	

TABLE VI. FETAL OUTCOME

GESTATION	TYPE OF PREVIA	DEAD ON ADMISSION	INTRANATAL DEATH	NEONATAL DEATH	LIVED
32-36 weeks	Low		1		6
	Partial	8	3	3	31
	Total	2	1	1	7
36-40 weeks and over	Low	2	1		25
	Partial	2	5	3	58
	Total	1		2	17
Total 32 weeks and over		15	11	9	144
Total all months		36	46	37	171
				254	

Ninety babies, 32 weeks or less in gestational age, were alive when the mothers were hospitalized.

Sixty-three of these babies died during or after labor. The high fetal mortality of this group was due to marked prematurity, and we believe that cesarean section in an heroic attempt to save such babies is not indicated.

One hundred sixty-four babies who had reached a maturity of 32 weeks or more were alive on admission. Of this number, 153, or 93 per cent, were born alive.

We do not believe that eventual fetal survival would have been altered notably by increasing our percentage of abdominal deliveries.

Summary and Conclusions

Two hundred eighty-three cases of placenta previa are reviewed.

Two hundred twenty-eight infants, or 80.6 per cent, were delivered through the birth canal.

Fifty-five, or 19.4 per cent, were delivered by cesarean section.

There were 2 maternal deaths, probably not due to the method of treatment of the placenta previa.

One hundred sixty-four babies had a gestational age of 32 weeks or more. Of this number, 153, or 93 per cent, were born alive.

Fifty-five babies were delivered abdominally and 46, or 83.6 per cent, were born alive.

It is apparent that:

1. Where bank blood is available in quantity, maternal safety is not jeopardized by conservative management.
2. Such management in properly selected cases does not affect the survival rate of viable babies adversely.

104 South Michigan Avenue

Discussion

DR. CHARLES P. McCARTNEY.—Cesarean section is being employed with increasing frequency as a means of resolving a wide variety of obstetrical difficulties. As a result of this trend, instances wherein the individual is unnecessarily subjected to abdominal delivery are increasing. Hence, Dr. Fitzgerald's presentation this evening is timely. He has demonstrated that by careful selection of cases and with adequate blood replacement many individuals with placenta previa can be delivered by the vaginal route without undue jeopardy to the mother or to the infant.

Dr. Fitzgerald's 19.4 per cent section incidence and 0.7 per cent maternal mortality rate afford a striking contrast to the 80 per cent cesarean section rate and a 1.5 per cent maternal mortality rate which has been reported by one large institution.

We also have abandoned the use of the intrauterine bag in the treatment of placenta previa. We agree with Dr. Fitzgerald that cesarean section for the primary purpose of attempting to save babies of marked prematurity is unjustified. We have found rupture of the membranes and the use of Willett's traction to be a valuable procedure in selected cases of partial placenta previa or low-lying placenta.

Our management of placenta previa differs from that of the essayist in that we feel that Braxton Hicks version is rarely indicated. Our incidence of Braxton Hicks version during the past twenty years has been 7.7 per cent. During the past five years this incidence has been 0.77 per cent. We feel that the patient who has a total placenta previa should be delivered by cesarean section; that the patient who has a partial placenta previa or even a low implantation of the placenta, and who has experienced an exsanguinating hemorrhage should likewise have a cesarean section. When pregnancy has to be terminated at 34 or 36 weeks in a patient who is not in labor, we feel that abdominal delivery is usually the treatment of choice, since it is rare for the cervix to be sufficiently ripe at this period to warrant an attempt at an induction of labor. In general, cesarean section carries an increased risk for both the mother and the infant. Its employment under these circumstances is justified in that the maternal hazard in delivery from below under these specific conditions is greater than the maternal and fetal mortality inherent in abdominal delivery.

Davis has reviewed placenta previa at Chicago Lying-in Hospital. The following facts are from his reports.

From 1931 to 1951, inclusive, there were 456 cases of placenta previa at this institution. From 1931 to 1945 there were 325 cases with an incidence of placenta previa of 0.79 per cent. During the period 1946 to 1951 there were 131 cases of placenta previa with an incidence of 0.56 per cent. The decline in the incidence of placenta previa during this latter period is attributed to a more accurate diagnosis of the etiology of bleeding during the third trimester of pregnancy. The incidence of total placenta previa was 27 per cent in the 1931 to 1945 period and 30 per cent in the period 1946 to 1951. This is higher than Dr. Fitzgerald's incidence of 12.3 per cent.

The cesarean section rate for placenta previa at Chicago Lying-in Hospital has increased from 44 per cent in the period 1931 to 1945 to 61.1 per cent in the period 1946 to 1951. This increase in the percentage of abdominal deliveries is the direct result of the employing of an expected plan of treatment in selected cases of placenta previa in which the infant was of borderline viability. This expectant plan of management was employed in 21.2 per cent of the cases of placenta previa during this latter period, 1946 to 1951, and was associated with a fetal survival rate of 86 per cent, as contrasted with an 81 per cent general fetal survival rate and a 74.4 per cent fetal survival rate for infants between 1,000 and 2,500 grams in placenta previa during this five-year period.

DR. CHARLES E. GALLOWAY.—A number of physicians advocate handling every case of placenta previa from a conservative standpoint by attempting to deliver from below. There was only one of Dr. Fitzgerald's patients who had had a previous placenta previa. I have had 2 patients who had had placenta previas, one on two different occasions and the other on three. I noticed that 19 of his patients had prolapse of the cord. The babies were lost in two of my cases because the cord was in what might be called the birth canal and either version or a bag would have resulted in death.

Dr. Fitzgerald does not advocate being too conservative after the thirty-fifth week because from the thirty-fifth to the fortieth week, well over 50 per cent of the cases were handled by cesarean section. In the last few years among private patients I have had 3 cases of placenta previa that have been handled conservatively, but out of those 3 cases I only got 2 live babies. One baby died suddenly after birth when we thought it should have lived. One patient lived in Winnetka and came into the hospital bleeding on August 5. She was kept in the hospital for a couple of weeks and then she persuaded me to allow her to go home, which I did, but she had a constant attendant. On September 3, early in the morning, she began to bleed profusely. We brought her in and did a cesarean section. Another patient entered the hospital at 34 weeks and we kept her in bed until she was practically at term when she again had another hemorrhage. We also handled her by section, but the baby died soon after birth. Another one, a primipara, was in the hospital for over a month preceding birth and got a normal live infant. At Cook County Hospital you can keep patients in bed, but in private practice it is difficult to keep patients in the hospital because of the cost. In this case the patient was anxious and willing, and we cooperated. We got a live baby for her. Since then she has had 2 other babies by cesarean section.

I wish to say something about the treatment of hemorrhage in placenta previa. O or Group IV blood with Witebsky's A and B Substance added makes universal blood that may be injected the same as glucose or any other intravenous fluid. I think it should be constantly on hand in every hospital because the time that is consumed in getting blood matched when a patient comes in with these terrific hemorrhages may be enough to cause the patient's death, whereas with O or Group IV blood to which can be added A and B Substance, you can have a patient transfused within 15 minutes from the time she reaches the hospital. No cross matching is necessary, but the Rh must be known beforehand and at the present time it generally is known.

PREGNANCY PROGNOSIS FOLLOWING REPEATED ABORTION

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WHEN three or more attempts at reproduction are repeatedly thwarted by spontaneous abortion, the patient is labeled as a habitual aborter and is usually given a poor prognosis for subsequent procreation. Although many of the factors responsible for abortion are either entirely obscure or incompletely understood, most experience has ascribed to this mishap a repetitive tendency. Thus the woman who has been plagued by a sequence of abortions is statistically handicapped in her further attempts at childbearing. While the validity of this concept is generally acknowledged, its quantitative aspect is a matter of considerable uncertainty. Some of the problems which becloud the subject were enumerated in a recent paper by King.[1]

Virtually all of the recent literature on pregnancy salvage in patients with a history of repeated abortion has been written against the background of a mathematical formulation devised by Malpas[2] in 1938 and subsequently modified by Eastman[3] in 1946. Their papers have carried the weight of authority and have had incalculable influence, both as a basis for professional counsel to patients and for the evaluation of methods of therapy. It is rather surprising, therefore, that neither of these papers has received the searching analysis that its importance would seem to warrant.

Malpas grouped all spontaneous abortions etiologically into two broad theoretical categories, those resulting from nonrecurrent or accidental causes and those due to recurrent factors. Women who abort from nonrecurrent causes are subject to no greater risk of aborting in subsequent pregnancies than if they had never experienced an abortion, whereas all pregnancies are doomed to miscarry among patients who harbor a recurrent factor.

If x represents the proportion of pregnancies that abort from nonrecurrent causes in a given population and y represents the proportion that abort from recurrent causes, then the frequency of all spontaneous abortions is $x + y$. A group of women who abort their first pregnancy thus have an abortion expectancy of $\frac{x^2 + y}{x + y}$ in their next pregnancy. After two consecutive abortions, the chance of aborting in the third pregnancy is $\frac{x^3 + y}{x^2 + y}$, and after n consecutive spontaneous abortions, the abortion expectancy is $\frac{x^{n+1} + y}{x^n + y}$.

By assigning arbitrary values to x and y, Malpas prepared a table showing the abortion risk among 100 women who become successively pregnant, prognosis depending upon the assigned values of x and y. Although his table contains some numerical errors, it demonstrates the transcendent importance of y in determining prognosis as the number of previous abortions increases. Malpas assumed 18 per cent as the frequency of spontaneous

abortion. His table shows that whatever values are arbitrarily assigned to x and y, the random causes are responsible for only a negligible proportion of further abortions after 3 or more abortions have occurred.

The principle of Malpas' theory is valid, but it is possible to take issue with his numerical values. The abortion incidence of 18 per cent was obtained from an examination of 2,000 "fraternities" (? families). This abortion rate is approximately double the figure arrived at by most students of abortion. A recent report by the Biological and Medical Committee of the Royal Commission on Population[4] concluded that the proportion of all pregnancies which terminate in spontaneous abortion lies between 7 per cent and 11 per cent. In his summary of the findings of various American authors, Hertig[5] concluded that 9.8 per cent of all pregnancies end in spontaneous abortion. One suspects, therefore, that Malpas' rate may have been based on an inadequate sample of the population, and one wonders also whether it included induced abortions.

Malpas assigned values of 17 and 1 to x and y, respectively, for his population, using the following reasoning. Among a group of about 6,000 pregnancies, there were 84 women who had had 3 or more consecutive abortions or stillbirths. From this he concluded that the proportion of women who had had 3 or more abortions was under 1 per cent and that this figure was, therefore, a reasonable value to assign to y. There seems to have been no basis for distinction between abortions and stillbirths, no certainty that all the abortions were spontaneous, and no segregation of the primary from the secondary habitual aborters. Primary habitual aborters are women whose sequence of 3 or more abortions begins with the first pregnancy, and secondary habitual aborters are women with a history of one or more viable pregnancies antedating their 3 abortion sequence.

As a check on the figures in his table, Malpas compared them with figures taken from a table compiled by Whitehouse,[6] showing the relation of abortion to parity. Malpas saw in the two sets of figures a rough correspondence, except after 4 abortions. He exempted from comparison, however, the observed and expected figures after 4 abortions because of the presumed effect of contraception, maternal ill health, reduction of fertility, and increasing maternal age.

Not only is such a limited comparison of dubious validity, but examination of Whitehouse's data shows them to be altogether unsuitable controls for Malpas' purpose. Whitehouse obtained his figures from 3,000 patients attending a gynecological clinic during the years 1909 to 1913 and 1924 to 1928, long antedating Malpas' study. Moreover, gynecological patients comprise a highly selected group with respect to abortion history. Whitehouse further made no distinction between spontaneous and induced abortions, nor between consecutive and nonconsecutive abortions.

For all these reasons, the conclusions drawn by Malpas are subject to reasonable doubt; a spontaneous abortion rate of 18 per cent is probably erroneously high; a value of 1 per cent for y in his formula may be grossly incorrect; and a succession of 3 spontaneous abortions does not necessarily indicate the presence of a recurrent cause.

A restatement of Malpas' idea was made in 1946 by Eastman, who applied a more realistic spontaneous abortion rate of 10 per cent to the Malpas formula. To the factors x and y Eastman assigned the values 9.6 per cent and 0.4 per cent, respectively, with the resultant figures shown in his table. Eastman's approach gives a woman with 3 successive abortions only a 16 per cent chance for a successful outcome of her next pregnancy, as compared with a 27 per cent chance according to Malpas.

Although the abortion rate of 10 per cent assumed by Eastman is probably a close approximation to the true rate, the proportion of this figure assigned to the crucial factor y requires further scrutiny. The value of 0.4 per cent for y, the frequency of abortion from recurrent causes, was credited to Bishop.[7] Perusal of the latter's paper has revealed an insecure basis for this value. Bishop reported a series of 100 initial abortions (abortions preceding a viable pregnancy) which occurred among 2,687 patients. Defining as habitual abortion "abortion for which no recognized organic cause such as syphilis or chronic nephritis can be found, occurring before the twenty-eighth week of pregnancy *on more than one occasion,*"* Bishop found only 11 cases that met this criterion, or 0.41 per cent of the total number of 2,687. Hence the figure of 0.4 per cent. It is important to note, however, that this definition of habitual abortion differs radically from that in common use, which requires a minimum of 3 sequential abortions. Of Bishop's 11 cases with more than 1 abortion, only 2 patients had more than 2 initial idiopathic abortions at less than 3 months, comprising only 0.07 per cent of the 2,687 cases. Because of the variations in Bishop's criteria from those currently accepted, and because of the small numbers in his study, his figures are obviously inadequate for the calculation of the factors for Eastman's table.

We are left, then, with an unsettled problem, the crux of which is the factor y, the frequency of abortion from recurrent causes. Estimates of the frequency of spontaneous abortion are sufficiently reliable for our purposes, but the ratio of the accidental to the recurrent factors remains to be established. What is needed, specifically, is a formulation of the prognosis for pregnancy, as a function of the number of previous abortions.

This information is needed to fill two voids. Intelligent advice to habitual aborters concerning future efforts at reproduction can be given only with some knowledge of prognosis. Second, evaluation of the therapeutic worth of alleged antiabortifacients requires control data on the successful pregnancy rate among untreated patients. The papers of Malpas and Eastman have rendered a service in stimulating interest in the problem, but the accuracy of their estimates is questionable.

Present Study

This study was planned in an effort to obtain empirical data on the chances of a successful pregnancy following a sequence of 3 or more spontaneous abortions. Habitual abortion is defined as a succession of 3 or more

*Italics are mine.

spontaneous abortions of a fetus of less than 1,000 grams. When the weight of the abortus was unknown, the diagnosis was based on a gestation of less than 28 weeks. Every effort was made to eliminate cases in which any question existed as to the spontaneity of the previous abortions; but by the very nature of the problem, it is unlikely that these efforts were completely successful. Only those cases were considered in which the patient had registered for antenatal care, either in the Sloane Clinic or with an attending obstetrician on the Sloane staff. Gynecologic patients or those who applied for care after the symptoms of abortion had appeared were excluded.

Records of the Sloane Hospital yielded 121 cases which met these criteria from July 1, 1948, to Dec. 31, 1952, out of a total of 17,490 obstetrical patients. Clinical antenatal supervision of the patients in the series varied with the physicians in charge, although the routine for clinic patients was fairly uniform. Twenty-four patients received private care by members of the attending staff. Ninety-seven were enrolled in the Sloane Clinic, which is staffed by both attending and house physicians.

TABLE I. OUTCOME OF PREGNANCY IN RELATION TO NUMBER OF PREVIOUS CONSECUTIVE ABORTIONS

PREVIOUS ABORTIONS	PATIENTS	CURRENT PREGNANCY			
		ABORTION	PREMATURE	TERM	PERCENTAGE VIABLE
3	66	7	7	52	89
4	33	10	8	15	70
5 or more	22	6	3	13	73
Total	121	23	18	80	81

The outcome of the current pregnancy was listed in relation to the past history of abortion. A general summary is presented in Table I. Of 66 patients with a history of 3 consecutive abortions, 89 per cent carried the pregnancy to viability (1,000 grams or more), 52 of the patients going to term, and 7 delivering premature babies (1,000-2,499 grams). The viable pregnancy rate among 55 patients with 4 or more abortions was somewhat lower (71 per cent), but of the entire group of 121 patients with a history of 3 or more consecutive abortions, 81 per cent carried to viability.

The abortion sequence began with the first pregnancy in 76, or 62.8 per cent, of the patients; and was preceded by a viable pregnancy in 45, or 37.2 per cent, of the cases. This ratio of primary to secondary habitual aborters is almost identical with that reported by Javert.[8] An interesting difference appeared between these 2 groups of patients when pregnancy outcome was determined separately for the primary habitual aborters and the secondary habitual aborters. These data are shown in Tables II and III. The over-all proportion of the primary habitual aborters whose pregnancies attained viability was 74 per cent, in contrast to 93 per cent for the group of secondary habitual aborters; and the figures consistently favored the secondary aborters in each of the gravidity groups. Thus among women with the same number of abortions, a better prognosis is suggested for the gravida who has once carried a pregnancy to viability than for the one who has aborted all previous pregnancies.

TABLE II. OUTCOME OF PREGNANCY IN RELATION TO NUMBER OF PREVIOUS PRIMARY CONSECUTIVE ABORTIONS

PREVIOUS ABORTIONS	PATIENTS	CURRENT PREGNANCY			
		ABORTION	PREMATURE	TERM	PERCENTAGE VIABLE
3	37	7	3	27	81
4	24	8	7	9	67
5 or more	15	5	2	8	67
Total	76	20	12	44	74

TABLE III. OUTCOME OF PREGNANCY IN RELATION TO NUMBER OF PREVIOUS SECONDARY CONSECUTIVE ABORTIONS

PREVIOUS ABORTIONS	PATIENTS	CURRENT PREGNANCY			
		ABORTION	PREMATURE	TERM	PERCENTAGE VIABLE
3	29	0	4	25	100
4	9	2	1	6	78
5 or more	7	1	1	5	86
Total	45	3	6	36	93

In each group the outcome was better for patients who had had only 3 previous abortions than for those who had aborted more than 3 times; whereas no apparent difference existed between patients who had had 4 previous abortions and those who had aborted more than 4 times.

Hormones were prescribed for 34 patients, or 28 per cent of the total. Among the 76 patients with a history of primary habitual abortion, 29 were treated with hormones as follows: 19 received stilbestrol, 5 received thyroid, 3 received stilbestrol and progesterone, 2 received stilbestrol and thyroid. Among the 45 patients with a history of secondary habitual abortion, 5 were treated with hormones as follows: 4 received stilbestrol and 1 received thyroid. Hormonal dosage schedules varied among the patients, but in the majority of cases in which stilbestrol was used the progressive dosage scale of the Smiths[9] was followed.

The patients who did not receive hormones comprised a slightly more favored group, in that only 55 per cent of them had never had a viable pregnancy previously, whereas 85 per cent of the patients who received hormones were primary habitual aborters. On the other hand, the two groups were almost exactly comparable with respect to number of previous abortions. In the group treated with hormones, 53 per cent of the patients had had 3 prior abortions, 31 per cent had had 4, and 16 per cent had had 5 or more. The corresponding percentages in the group of untreated patients were 56, 26, and 18.

Of the 34 patients treated with hormones, 16 went to term, 6 delivered prematurely, and 12 aborted. Thus 22 of 34 patients, or 65 per cent, carried to viability, as compared with 87 per cent for the group of 87 patients not treated with hormones. While these figures do not differ significantly, they show that the good results achieved by the patients in this study cannot be ascribed to hormonal therapy.

Comment

The belief is deeply entrenched that abortion has a strong tendency toward recurrence, but the evidence for this view is not conclusive. Gardiner and Yerushalmy,[10] in a study of the statistics of New York State exclusive of New York City, found that the neonatal mortality and the stillbirth rates of infants born to mothers who had previously suffered one or more infant losses was more than twice that of infants whose mothers had had no such loss previously; and that the increase in mortality varied directly with the number of previous infant losses. The frequency of premature births, similarly, was increased among mothers with a history of previous infant losses. These statistics do not specifically deal with the recurrence of spontaneous abortion; but the presumed biological relation between abortion and premature labor has validated in the minds of some students the application to one phenomenon characteristics of the other.

Tietze[11] in 1948 reported on the incidence of abortion among 30,133 previous pregnancies in 10,397 plurigravid patients at the Johns Hopkins Hospital. The abortion ratio was higher, to be sure, among the previous pregnancies of the aborting patients (22.3 per cent) than among the parturient patients (16.0 per cent); but the inclusion of induced abortions, resulting in a total abortion rate of 17 per cent, vitiates conclusions concerning the spontaneous process.

The same author, together with Guttmacher and Rubin,[12] later made a study of some factors which favored unintentional abortion in 1,497 planned pregnancies in private patients. The authors stated that the incidence of abortion was greatly increased when the woman was of advanced age, when there was a history of previous abortion, and when an unduly long time was required for conception after the abandonment of contraception. These three factors were correlated, however, and the published data do not permit an evaluation of the effect of previous abortion alone with the other two variables kept constant.

A very recent paper by Shoeneck[13] analyzes the past obstetrical histories of 5,000 patients from the files of the Bureau of Maternal Hygiene of the Department of Health in Syracuse, N. Y. These figures suggest a repetitive tendency toward abortion in women who have once aborted, but the total numbers are too small to be significant. There were only 15 patients in the whole group, for example, whose first 3 pregnancies had ended in abortion; but it is interesting that not a single one of these women aborted in her fourth pregnancy.

Although the literature on habitual abortion is large, the composite data are disappointingly meager. The review by Hertig and Livingstone includes a tabulation of 34 published reports on treatment of this condition, but the number of cases in each report lies between the limits of 1 and 63. The paucity of published case material becomes even more impressive when it is recalled

that the criterion of habitual abortion used by Hertig and Livingstone was at least 2 consecutive spontaneous abortions, rather than the more generally accepted number of 3 or more.

The present report likewise, because of its small number of only 121 cases of habitual abortion, can make no pretense at providing statistically valid prognostic conclusions. Moreover, the figures can only be approximations toward the true abortion frequency in women with previous abortion sequences, because the results are based only on registered pregnancies and fail to take into account abortions which occur in patients very early in pregnancy, before the usual time of antenatal registration. It must further be noted that the data relating to attainment of viability do not imply infant survival but are based solely on the criterion of pregnancy duration, as judged by fetal weight or weeks of gestation. The study does, however, provide grounds for questioning certain established concepts of the natural history of abortion sequences. Furthermore, although not expressly designed for the purpose, it permits a partial appraisal of some widely heralded hormonal prophylactic programs.

The prognosis for a viable pregnancy in women with a previous succession of 3 or more abortions appears far better from the data of this study than is indicated by the estimates of Malpas and of Eastman. Specifically, we have found that 81 per cent of our patients with a primary 3 abortion sequence carried to viability in a fourth pregnancy, as contrasted to Malpas' estimate of 27 per cent and Eastman's prediction of 16 per cent. This means, of course, that the proportion of pregnancies which abort because of a recurrent factor is probably much smaller than the 1 per cent postulated by Malpas or even the 0.4 per cent used by Eastman. It would appear, therefore, that sequential abortion is largely a matter of chance.

It has already been shown that the high proportion of pregnancies which attained viability in this series cannot be attributed to hormonal therapy. It is of interest, therefore, to compare these results with those obtained under various regimes of specific hormonal prophylaxis. Olive Smith, an ardent advocate of diethylstilbestrol for a variety of pregnancy complications, stated that the results from her method of treatment "cannot possibly be ascribed to chance, and seem to establish beyond any reasonable doubt the value of stilbestrol in habitual abortion." Eighty-seven per cent of her 38 patients with a history of 3 previous abortions carried their pregnancies to the twenty-eighth week, as did 65 per cent of 17 patients with 4 previous abortions. The data of the present study show almost identical figures.

Similar results have been obtained by intensive treatment with progesterone by Davis and Fugo[14] and by Bishop and Richards[15]; but Swyer's[16] recent study of pregnandiol excretion in cases of habitual abortion offers no support to the view that deficient metabolism of progesterone is an important cause of repeated miscarriage.

Jones and Delfs[17] have been more selective in their management of patients with a history of abortion, individualizing treatment according to the

results of a meticulous diagnostic survey, including studies of thyroid function, serum tocopherols, and urinary hormonal excretion. Lowered thyroid function was judged to exist in 63.5 per cent of their patients with 3 or more consecutive abortions. Among 51 selected pregnancies which were treated according to the specific indications disclosed by diagnostic studies, 78 per cent carried to term.

In a recent report Bevis[18] offers an interesting interpretation of the excellent results achieved by his group of 32 patients who had had 3 or more previous abortions. These patients were all subjected to a number of diagnostic procedures, including measurements of basal metabolic rate, glucose tolerance, and urinary pregnandiol excretion. They were advised to take extra rest at the time their menses would have been due but received no other specific treatment that could have had any conceivable relation to the outcome of pregnancy. Without the benefit of any hormonal therapy, 29 patients, or 91 per cent, reached the twenty-eighth week of pregnancy and 26 of the babies (81 per cent) were born alive and well. Bevis laid great emphasis on the high degree of confidence that his patients had in his investigation, and to this psychological support, given unwittingly, he attributed a large measure of the success achieved. If Bevis is correct in his contention that psychotherapy is the most valuable form of treatment for patients with a history of sequential abortion, serious consideration must be given to the possibility that psychogenic factors play an important part in the causation of this aberration of reproductive function.

Summary

1. Analysis of the literature on habitual abortion has revealed a questionable basis for the gloomy prognosis that is currently given to the woman with a history of 3 or more consecutive spontaneous abortions.

2. The high abortion rates predicted for these patients have resulted from the uncritical acceptance of poorly founded estimates of the frequency of recurrent causes.

3. In the present study, 81 per cent of a series of 121 women with a history of 3 or more consecutive abortions carried their pregnancies to viability.

4. A woman with only 3 consecutive abortions had a better prognosis in a subsequent pregnancy than a woman with more than 3 consecutive abortions.

5. A woman with a viable pregnancy antedating her abortion sequence had a better prognosis in a subsequent pregnancy than a woman whose abortion sequence began with her first pregnancy.

6. Hormonal therapy was of no apparent value in the treatment of this group of sequential aborters.

7. The excellent results that have been imputed to various therapies are predicated on an unfounded pessimism over pregnancy outcome in the untreated patient.

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ISOMETRIC PELVIMETRY

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THE value of pelvic radiography in selected cases as an adjunct to the intelligent management of pregnancy at or near term has long been established. It is becoming increasingly evident to those in the practice of obstetrics that clinical measurements of the pelvis can be misleading, and this has been corroborated by the work of Caldwell,[1, 2] Moloy,[1, 2] Williams,[4] Snow,[5] Thoms,[3, 10] Mengert,[6] Javert,[7, 11] Steele,[7] McLane,[8] and many others. Ever since the introduction of the pelvic measuring ruler by Granzow in 1930, there have been many roentgen techniques devised. The achievement of the highest degree of accuracy in the measurement of pelvic capacity has been the aim of some of these investigators. Many of the methods, however, are all out of proportion to clinical practicability.

Since there are a number of factors involved in labor other than the actual size of the bony pelvic canal, any method which is accurate to within 0.5 cm. in any pelvic dimension must be considered clinically acceptable (Thoms). In achieving an ideal method of x-ray pelvimetry, a purely quantitative approach to the problem is not sufficient. The method with most universal appeal should be one that offers a complete survey of pelvic architecture and cephalopelvic relationship, and one which can be interpreted by the obstetrician with ease. From the technician's point of view, the method should be uncomplicated to set up, and, to the patient, it should cause minimal discomfort. It should utilize a minimum of exposure to x-rays. The method should be readily adaptable for use not only in teaching clinics, but also in the farthest outposts of medical practice where an x-ray machine is available. In our experience, isometric pelvimetry more closely approaches the ideal than any one of the many techniques currently in use throughout the country.

Steele and Javert[7] used this method combined with the stereoscopic studies of Caldwell and Moloy[1, 2] and published their report in 1942. Javert published another report in 1943. Later, McLane[8] found that the error between the stereoscopic and isometric techniques was negligible. He pointed out that the isometric gave as much information, and certainly was easier to interpret. It also took much less time for one to become proficient in its use than the stereoscopic. It is this form of isometric pelvimetry that we have used at Georgetown University Hospital for the past four and one-half years. We should like to offer a preliminary report on and a discussion of our experience during this period with the technique and interpretation of the films.

Materials

The present study consists of 700 unselected consecutive pelvic series obtained on patients at term or during labor. At this hospital, pelvimetry is performed on specific indications for the most part, although house officers are encouraged to order studies routinely on primigravidas in the clinic. Comments will be made later on other indications for pelvimetric study in this group of patients.

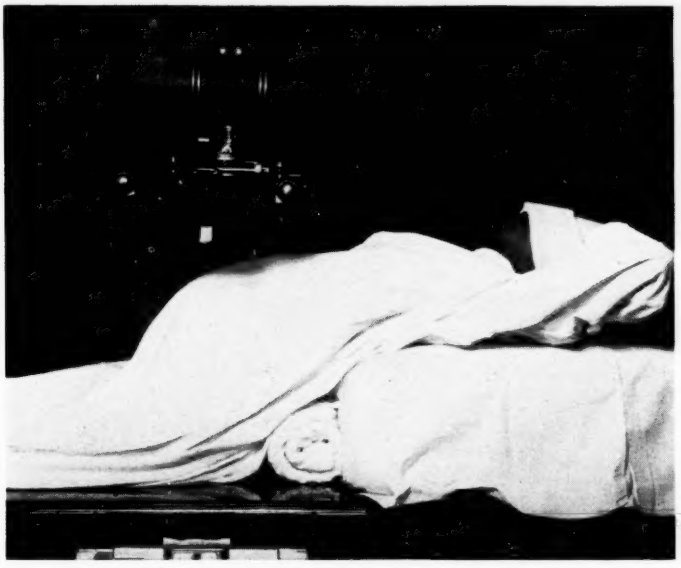

Fig. 1.—Position of patient for frontal film.

Technique

Routine study of the birth canal and its contents is made by utilizing two films. In the presence of breech, transverse, or oblique presentations, twins, or instances of a floating head so high that it cannot be seen in the regular films, a flat plate of the abdomen is also taken. We have been using a General Electric machine with a rotating anode tube. For the frontal film, the patient is placed on the x-ray table as shown in Fig. 1. A 4 inch sheet roll is placed against the lumbosacral curvature, and three firm pillows are arranged lengthwise beneath the shoulders and back. This position angulates the pelvis forward and brings the inlet parallel or almost parallel to the table, effecting an undistorted view of the pelvic inlet. In our experience, the use of 11 by 14 films has produced the most satisfactory results. With very small patients, 10 by 12 films may be used. The principal advantage of the use of the smaller films lies in the fact that more careful centering of the patient and of the cone is required of the technician. A smaller cone may be used, thus producing a lesser amount of secondary radiation. Rarely, a 14 by 17 film is required for an extremely large patient.

For the frontal view, the tube is placed 25 inches from the film and is centered over the patient on a line between the anterior superior iliac spines. A Bucky diaphragm is used and one film is taken. The duration and amount of exposure naturally vary with the size of the patient. We have found that optimal results are produced with a 28 cm. distance, 100 Ma. and 85 kv., at one and one-half seconds' exposure. Fig. 2 is an illustration of the frontal view of the pelvis so obtained.

The patient assumes the same position for the lateral film (Fig. 3). In this case, however, she is moved to a standard hospital stretcher which has been covered with a rigid plywood board. A notched metal centimeter rule is placed in front of the symphysis in a vertical position. This ruler may be set in a wooden-block base. However, a more satisfactory type is one whose stander is made of the same thin metal turned at right angles to the base of the ruler. With this type, the stander may be slipped under the buttocks, thus assuring a closer approximation of the ruler to the anterior aspect of the symphysis as well as a more exact vertical position on the film. The x-ray table is turned to the vertical, and the patient is rolled into position in front of it with one hip touching the table. The tube for this lateral film is centered at 36 inch tube distance on a line equidistant between the trochanters and the posterior superior iliac spines. In our series, the intertrochanteric measurement averaged 28 to 32 cm. and in these cases a three-second exposure with 100 Ma. and 95 kv. was used with excellent technical results. Here again variations in strength and exposure time must be made according to the size of the patient. Fig. 4 represents a lateral view of the pelvis obtained by this technique.

Fig. 2.—Frontal film.

Marking of Films

Marking of Lateral Film (Fig. 5).—All lines are drawn on films with a soft, red wax pencil. The figures demonstrating the marking of the films are diagrammatic since reproduction of even the most perfect x-ray is often disappointing.

1. A-P of inlet (obstetric conjugate): This line is drawn through the plane of the iliopectineal lines and is extended through the points where they are projected from the posterior surface of the symphysis, utilizing its full thickness, to the anterior surface of the sacrum. Note that the sacral promontory is not considered to be the posterior limit of the obstetric conjugate.

2. Division of the inlet into anterior and posterior sagittals: A line (T-S) is dropped at right angles from the A-P through the tips of the ischial spines.

3. Location of the anterior transverse: A line (AT-TU) is dropped at right angles from the A-P through the lowest point of the arc formed by the ischial tuberosities.

4. Posterior sagittal of midpelvis: A line is drawn at right angles to line T-S at point S passing from the tips of the ischial spines to the anterior surface of the sacrum.

5. Posterior sagittal of the outlet: A line is drawn from the inner aspect of the tip of the sacrum to the point where line AT-TU transects the lowermost point of the arc of the ischial tuberosities.

Fig. 3.—Position of patient for lateral film.

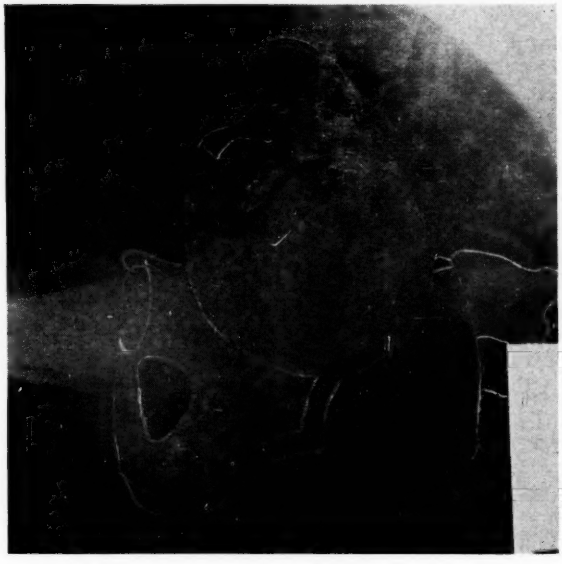

Fig. 4.—Lateral film.

6. Base line: A line is drawn parallel to the base of the film at the inferior border of the metal ruler.

Marking of Frontal Film (Fig. 6).—

1. Posterior transverse (PT_1-PT_2): A line (PT_1-PT_2) is drawn between the posterior superior iliac protuberances.

2. Transverse (of inlet T_1-T_2): A line (T_1-T_2) is drawn through the widest transverse diameter of the inlet.

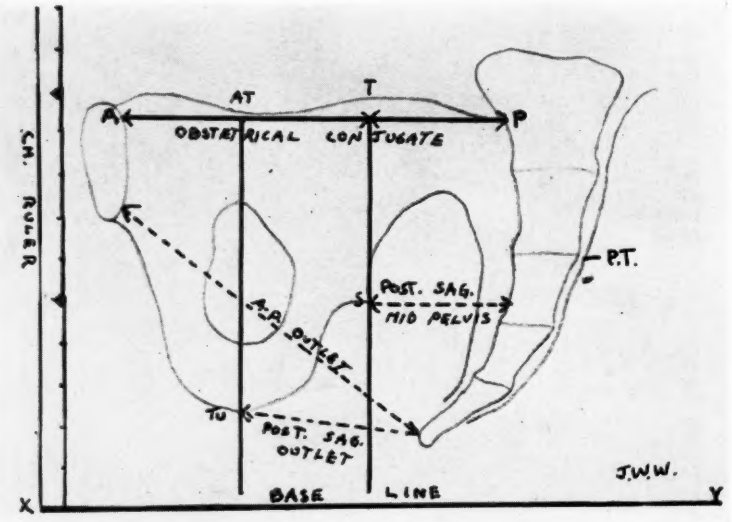

Fig. 5.—Marking of lateral film.

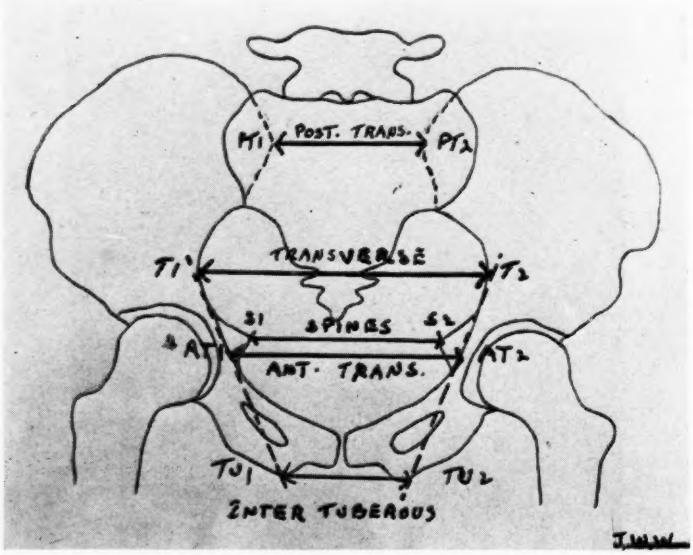

Fig. 6.—Marking of frontal film.

3. Anterior transverse (AT_1-AT_2): A line (AT_1-AT_2) is drawn between the iliopectineal eminences. They are situated at the mesial aspect of the thinnest portion of the acetabula.

4. Interspinous (S_1-S_2): A line (S_1-S_2) is drawn between the tips of the ischial spines.

5. Intertuberous: Lines are dropped along the side walls of the pelvis through the most dependent parts of the pubic rami. The distance between these points (TU_1-TU_2) represents the intertuberous diameter.

Measurement of Diameters

Lateral Film (Fig. 5).—The diameters are measured with a pair of dividers. These are spread along the lines between the points desired, and measurements are made directly on the notched centimeter rule. The distortion of these planes is identical with that of the ruler because they are equidistant from the film.

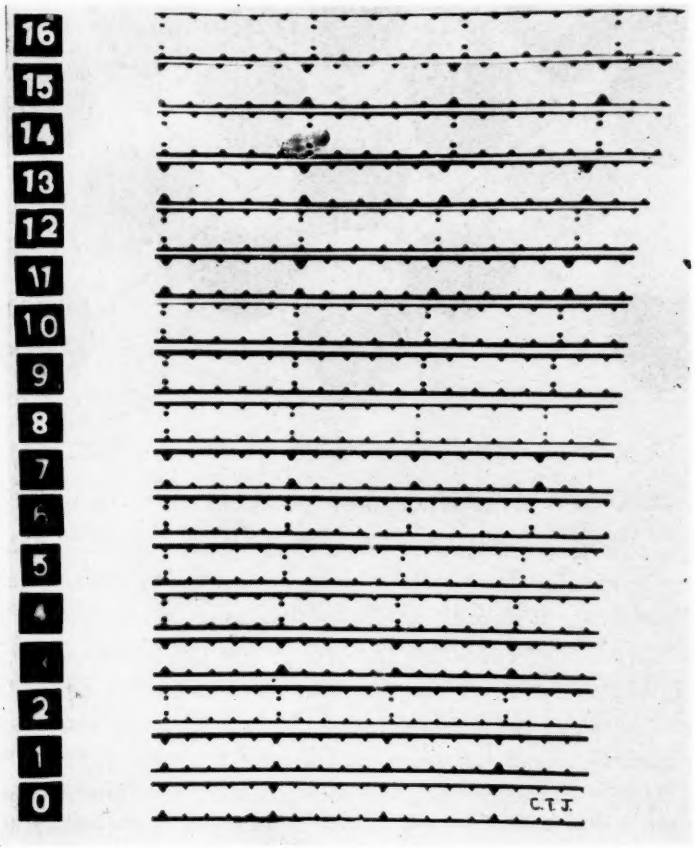

Fig. 7.—Distorted centimeter scale (from Javert).

The vertical heights of the P.T. (level marked at the posterior level of the junction of S_2 and S_3), T, A-T, S, and T-U are measured from the base line X-Y. These heights are recorded on the report sheet to the left of the appropriate planes to be measured from the frontal film. Inasmuch as the patient is positioned the same for both films, all the levels in the pelvis are equidistant from the table in both films. A sample report sheet is shown on page 682.

Frontal Film (Fig. 6).—The calipers are next spread between the points P-T_1 and P-T_2, T_1 and T_2, AT_1 and AT_2, S_1 and S_2, TU_1 and TU_2. These are measured on the distorted centimeter scale (Fig. 7), at the levels previously

determined on the lateral film. For example, to measure the transverse of the inlet T_1-T_2; assume that it had previously been determined that the level of the point T is 11 cm. above the base line X-Y. The dividers are spread between the points T_1-T_2 and measured on the distorted scale at the 11 cm. level, etc.

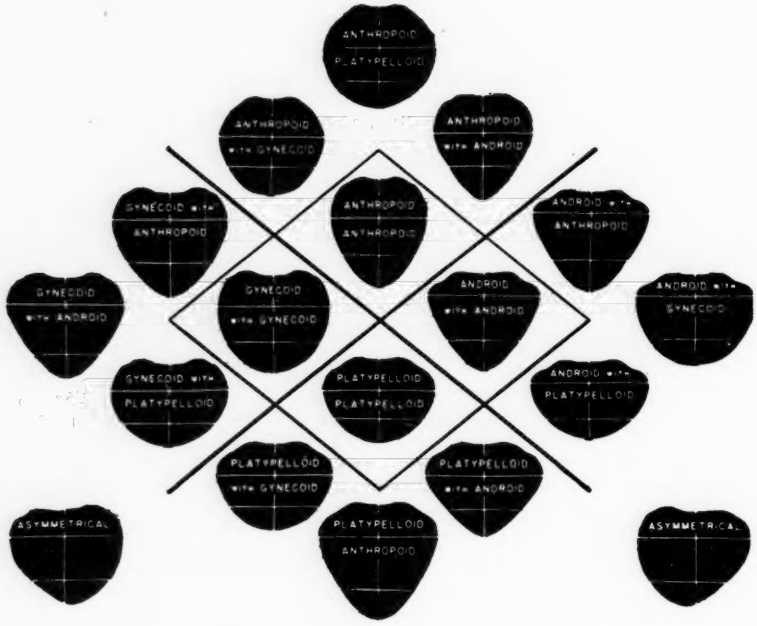

Fig. 8.—Inlet types (after Caldwell and Moloy).

Interpretation of Films

A. Morphologic Classification of the Pelvis (frontal film).—The pelvic inlet is classified according to its shape. The classification is broken down into the parent type (posterior segment) and daughter type (anterior segment). The division of segments is created by the transverse diameter of the inlet which had previously been drawn. Thus, the inlet is classified as one of sixteen possible variations or an asymmetrical type. This is done in our clinic by using cleared films on which had been drawn the various inlet types after Caldwell and Moloy (Fig. 8). The tracings are compared to or superimposed upon the inlet in question. The inlet is then described after the tracing it most closely follows in outline.

The pelvic architecture is next checked as to whether the inlet has a pure, mixed, or asymmetrical form. Its relative size is then noted as being large, average, or small.

The morphology of the inlet influences the position of the presenting part in its entry into the pelvis. In gynecoid pelves, most occipital presentations enter the inlet in a true or almost true transverse position. Should the pelvis be android, with its typical anterior narrowing, the head will seek a transverse to posterior position. Conversely, if the posterior segment of the inlet tends

to be narrowed, the head will favor an anterior position. A platypelloid inlet will favor a true occiput transverse position. Anthropoid inlets favor true occiput anterior or posterior positions only when there is significant narrowing of the transverse diameter. Otherwise the head most frequently enters in the transverse.

B. Sacrosciatic Notch (lateral film, Fig. 9).—The apex and base of the sacrosciatic notch are next examined and checked as wide, average, or narrow. In a pelvis with a shallow posterior segment, one would rightfully expect a narrow apex. However, its base would depend entirely on the inclination and shape of the sacrum. We often see, for example, a pelvis with an anthropoid inlet in which the apex of the notch may be average to wide. The sacrum may incline forward to such a degree, or may be so straight as to narrow the base. If the base is narrow, one should expect a shortened posterior sagittal of the midpelvis with all its connotations.

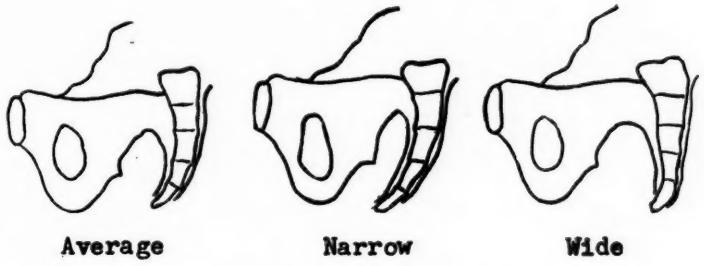

Fig. 9.—Sacrosciatic notch.

The posterior sagittal diameter of the midpelvis, therefore, parallels the base of the sacrosciatic notch. In our series we have felt that the posterior sagittal diameter is adequate when it measures 5 cm. or more. Furthermore, it is our impression that Thoms' law may be applied to the midpelvis as well as to the outlet. As the posterior sagittal diameter of the midpelvis becomes shorter, the interspinous diameter must increase to obviate midpelvic dystocia. Further study of the midpelvis in this light is contemplated in the near future.

C. Inclination of the Sacrum (lateral film).—The inclination of the sacrum is noted. This is determined by placing a straightedge between the point of the sacrum where it is crossed by the iliopectineal lines and the inner border of the sacrococcygeal joint. It is accordingly determined whether the sacral inclination is forward, average, straight, or backward. It might be noted at this point whether the sacrum is unusually short or long. The significance of sacral inclination is manifested by its possible influence on labor. For example, a sacrum which is inclined abnormally forward might be expected to retard progress in the midpelvis, and might even contribute to deep transverse arrest and failure to rotate.

D. Number of Sacral Segments (lateral film).—The number of sacral segments is counted and reported. Complete or partial sacralization of the fifth

GEORGETOWN UNIVERSITY MEDICAL CENTER

GEORGETOWN UNIVERSITY HOSPITAL

Washington, D. C.

Department of Roentgenology — X-RAY PELVIMETRY

Date August 1, 1952

X-ray No. xxxxxx

Room OPD

Doctor xxxxxx

NAME:	Family	First	Middle	Age	Color	Para	Gravida
	Doe	Jane		21	W	0	1

INDICATIONS:

Primigravida at term, routine

Frontal film

(Trans. Diameter)

7 POST. TRANS. 7.0 cm.
11 TRANSVERSE 12.5 cm.
11 ANT. TRANS. 10.0 cm.
5 SPINES 11.0 cm.
3 T. I. 11.5 cm.

Lateral film

(AP Diameter)

C.O. OF INLET 11.5 cm.
POST. SAG. OF INLET 5.0 cm.
ANT. SAG. OF INLET 6.5 cm.
POST. SAG. OF MIDPELVIS 5.0 cm.
POST. SAG. OF OUTLET 8.0 cm.
A.P. OF OUTLET 12.5 cm.

MORPHOLOGIC CLASSIFICATION OF THE PELVIS

Posterior Segment	Anterior Segment
Gynecoid x	Gynecoid x
Android	Android
Anthropoid	Anthropoid
Platypelloid	Platypelloid

Pelvic Architecture	Size
Pure Form x	Large
Mixed Form	Average x
Asymmetrical	Small

Face of report sheet

Sacrosciatic Notch

	Apex	Base
Wide		
Average	x	x
Narrow		

No. Sacral Segments
- Five x
- Six

Spines
- Prominent
- Average x
- Blunt

Lateral Bore
- Convergent x
- Straight
- Divergent

Position
- L.O.A.

Station
- Brim
- Above Spines x
- At Spines
- Below Spines

Cephalometry
- OF
- Bip. 9.5
- SOB

Transverse Arrest

Spontaneous Rotation x

P.O.P.

O.A. x

IMPRESSION:

Inclination of Sacrum
- Forward
- Average x
- Backward
- Straight
- Length

Curvature of Sacrum
- Straight
- Average x
- Marked

Tip of Sacrum
- Forward
- Average x
- Straight
- Marked

Side Walls
- Convergent x
- Straight
- Divergent

Mechanism of Labor

Obliquity
- Neutral
- Naegle x
- Litzmann

Flexion
- Good x
- Neutral
- Poor

Cephalopelvic relationship

Prognosis

Delivery
- Vaginal x
- Abdominal
- Forceps

There is no evidence of cephalopelvic disproportion, vaginal delivery is anticipated.

Signed:

Back of report sheet

lumbar should be recorded at this point. If any abnormality of the sacral hiatus is seen, it should be reported here to warn against attempted caudal anesthesia.

E. Curvature of Sacrum (lateral film, Fig. 10).—The curvature of the sacrum is checked as being average, marked, or straight. Its influence on labor is practically the same as its inclination. For example, a straight sacrum may retard rotation of the head. There are instances when the very straight or sharply angulated sacrum may be the only obvious manifestation of childhood rickets.

Fig. 10.—Curvature of sacrum.

F. Tip of Sacrum (lateral film).—The tip of the sacrum may be forward, average, straight, or rarely backward. The posterior sagittal is measured from the tip of the sacrum at its inner aspect, to the transverse of the outlet. Its position, therefore, is important in its influence on the posterior sagittal diameter. It thus invokes Thoms' law for contraction of the outlet. It is a reminder to the obstetrician that, when the tip is forward, the parturient may need a greater transverse diameter of the outlet to permit successful delivery.

In our experience we have found only two situations in which pure outlet contraction exists. This occurs when the sacrum is unusually long and inclined forward, or when it is acutely angulated to such a degree as to cause shortening of the posterior sagittal of the outlet. Therefore, in the absence of these very rare conditions, one might expect concomitant midpelvic contraction in the presence of a contracted outlet. However, we occasionally encounter midpelvic contraction without outlet contraction.

G. Ischial Spines (frontal film, Fig. 11).—The ischial spines are seen to best advantage on the frontal film and are described as being prominent, average, or blunt. Pelves with anthropoid and android inlets may be expected to have prominent spines which project appreciably into the midpelvis. They may contribute to arrest at, or slightly above, the midpelvis in the course of labor. Their prominence must not be lightly regarded in this respect, particularly, if the interspinous measurement is equal to or less than the average biparietal measurement of the baby's head at term.

H. Side Walls (frontal film, Fig. 12).—The side walls of the midpelvis are described as being convergent, straight, or divergent. It does not necessarily

follow that convergent side walls are coexistent with prominent spines, nor is the converse always true. In our series, most side walls are convergent. Yet, only in those pelves in which the convergence led to notable midpelvic or outlet contraction did their influence on labor become important.

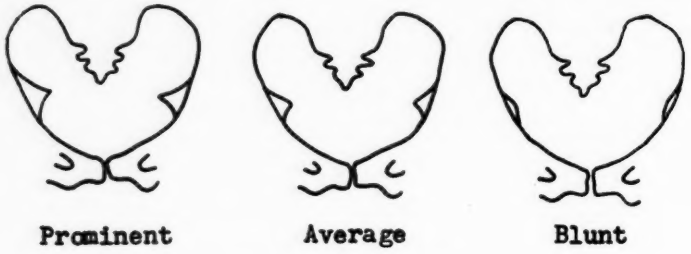

Fig. 11.—Ischial spines.

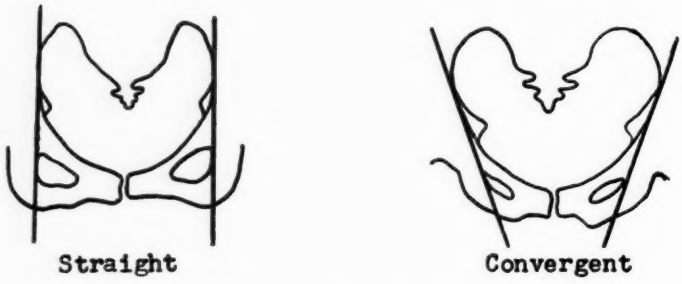

Fig. 12.—Pelvic side walls.

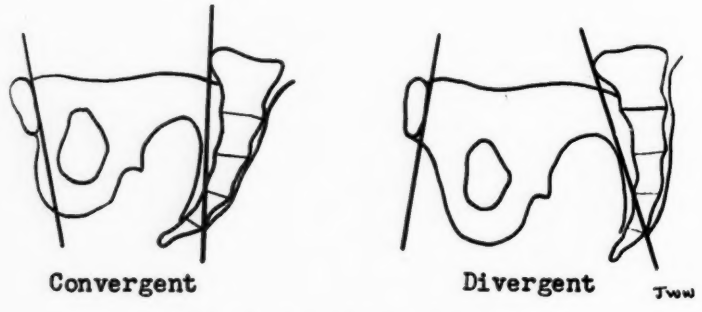

Fig. 13.—Lateral bore of pelvis.

I. Lateral Bore (lateral film, Fig. 13).—The appreciation of the convergence, divergence, or straight characteristic of the lateral bore helps us to think of the pelvis as a cylinder through which a pistonlike object is to pass. The lateral bore is determined by placing a straightedge along the posterior aspect of the symphysis and another along the internal borders of the first three sacral segments. The significance of the lateral bore becomes obvious. Should the bore be markedly convergent, it will necessarily contribute to increased molding of the fetal head and prolongation of labor.

J. Position (frontal and lateral films, Fig. 14).—If the vertex is presenting, the position of the fetal head can be determined accurately. Should the orbits be visible, the location of the occiput is simplified. However, we use the shadows of the petrous portions of the temporal bones to determine the position of the occiput because these are practically universally discernible. These petrous ridges form the letter V, and the open, or diverging arms of the V point toward the occiput. The occiput is thus located in a particular quadrant of the mother's pelvis. This may be corroborated by viewing the lateral films. A landmark easily utilized in the lateral film is the shadow of the mandible. In our experience, during the time which elapses between taking the two views, the fetal head frequently shifts position slightly, for example, from LOT to LOP. The position is then reported in that manner.

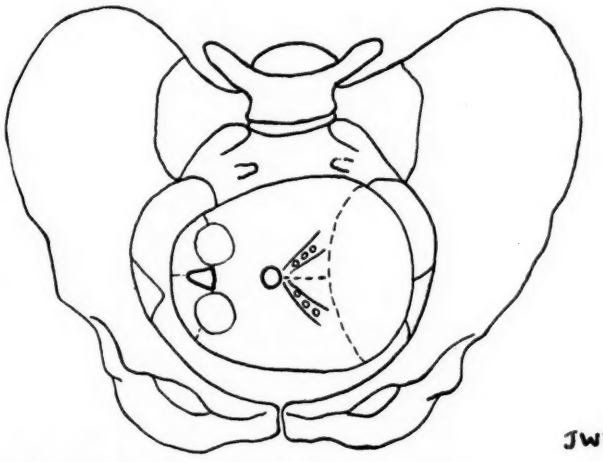

Fig. 14.—Frontal view of pelvis. This figure demonstrates the landmarks used in determining the position of the fetal head. The orbitis and nasal foramen are not usually very clearly demarcated. The petrous ridges are almost always visible. They form a V, the open arms of which point to the occiput.

K. Obliquity (lateral film, Fig. 15).—Obliquity refers to the type of lateral flexion of the head as it enters the inlet. Should the posterior parietal bone be in a deeper plane, the obliquity is referred to as Litzmann's. If the anterior parietal bone is entering first, then it is called Naegele's obliquity. We have not made an analysis of obliquity, but it is our impression that most occiputs enter the pelvis with the anterior parietal bone at a deeper plane.

L. Station (lateral film).—The station of the presenting part may be seen readily in the lateral film. It is reported as floating, at the brim, above, at, or below the level of the spines. The majority of our patients showed nonengagement. The significance of station is obvious and need not be enlarged upon.

M. Flexion (lateral film).—The degree of flexion of the head is determined by study of the lateral film. As it has been noted repeatedly by numerous observers, the occiput in most posterior positions tends to be less adequately flexed than in direct anterior and transverse positions. Flexion is also in-

fluenced by station. It becomes improved, for the most part, as the head enters the inlet and descends toward the midpelvis. Should the head be imperfectly flexed during descent, dystocia may ensue as a result of the larger diameters of the vertex being forced through the pelvis. It is uncommon for a head that is well flexed prior to the onset of labor to become deflexed. It is similarly important to note the degree of flexion in breech presentations.

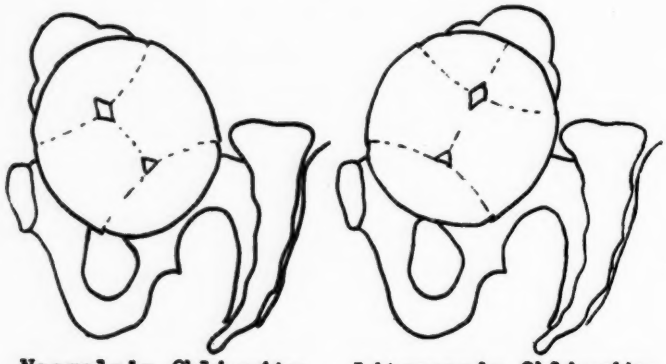

Fig. 15.—Asynclitism or obliquity.

N. Cephalometry (lateral and frontal films).—Utilizing this two-film method of isometric pelvimetry, the biparietal diameter of the fetal head may be measured with reasonable accuracy from the frontal and lateral films when the head is in the direct transverse or direct A-P diameters. Measurement is less accurate in the oblique diameters, and difficult, and sometimes not at all accurate, in breech presentations. The biparietal diameter of fetal heads at term varies in our clinic from 8.5 cm. to slightly more than 9.5 cm. In our experience, the absolute measurement of the biparietal, occipitofrontal, and suboccipitobregmatic diameters are not of much clinical significance save in cases of hydrocephalus. When hydrocephalus of any degree exists, the prognosis of labor is immediately changed.

O. Cephalopelvic Relationship (frontal and lateral films).—Probably the most important impression that one can get from studying any pelvimetry is cephalopelvic relationship. This overshadows all absolute measurements. By studying both films, good judgment must be exercised in deciding whether or not the particular head visualized has adequate room in the passages. It must be remembered that the passages are fixed and that the dynamics of labor and moldability of the fetal head are entities to be reckoned with. One must appraise the pelvis in the light of the possible degrees of flexion and rotation which may occur during labor. These factors cannot be broken down into simple figures. Nevertheless, any diameter which falls short of the average measurements must be considered contracted and treated as such. Thus cephalopelvic relationship is judged as being good, poor, or bad. If it is poor or bad, then comment should be directed to that level at which the discrepancy is thought to exist, i.e., "poor at the inlet," "snug or poor at the midpelvis."

P. Prognosis (lateral and frontal films).—In the attempt to arrive at a prognosis, all the foregoing data are evaluated. Questionable pelvic measurements and contours should be assayed. Then their relationship to the fetal head is carefully weighed and a statement is made relative to the future course and outcome of labor. However, where actual disproportion is not in evidence, but where there seems to be a snug relationship at some level of the pelvis, the attending physician is forewarned of the apparent facts. He will then be alerted to the possibility of dystocia and will observe more carefully the baby's progress through these diameters. It is possible, also, to advise the operator at which level forceps rotation is best effected should such a maneuver become necessary.

In a consideration of breech presentations, there is no hesitation in recommending abdominal section when one finds an average to large baby associated with borderline or contracted diameters. In the same pelvis a vertex presentation with some molding could achieve a successful and happy outcome per vaginam.

A great aid to the person reading the films is a request slip which should include pertinent information. Ideally, the patient's age, gravidity, and parity, history and outcome of previous labors, if any, should be noted. If a patient is a primigravida, then a clear-cut indication for the pelvimetry should be furnished. It becomes obvious, therefore, how recommendations might be justly altered in view of the complete information.

Results

A brief analysis is now made of our results in the first 700 unselected cases in which x-ray pelvimetry was used. We fully realize that this small series is not statistically very significant. However, it serves the purpose of demonstrating the value of this technique of mensuration in our hands.

The patients surveyed varied in age from 14 to 42 years. Young primigravidas (16 years of age or younger) constituted 3.3 per cent of our series, while 5.7 per cent were elderly primigravidas (35 years of age or older). A little over four-fifths (82.4 per cent) of the total number were primigravidas. The Negro group, for the most part, were from our outpatient clinic. Approximately half (47.2 per cent) of the total series were private patients attended by our staff physicians.

The indications for pelvimetry are noted in Table I. It was of interest to us that 56 per cent were either routine studies or those in which no reason was given for the requested survey. The remainder were cases in which an obstetrical indication was present.

The remaining indications for pelvimetry included: multipara with breech (3), floating head in labor (3), previous fractured pelvis or spine (3), first baby died post partum or in labor (3), postmaturity (2), head high and antepartum bleeding (2), polio with residual paralysis of lower extremities (2), transverse lie plus myoma (1), tumor in cul-de-sac (1), previous large baby (1), flaring subpubic arch (1), long period of sterility (1), questionable hydrocephalus (1), congenital chondrodysplasia and kyphoscoliosis (1).

TABLE I. INDICATIONS FOR PELVIMETRY

INDICATION	NO. OF CASES
Routine, including those for which no reason was given	393
Unengaged head in a primigravida at term or in early labor	58
Clinically borderline or contracted pelvis	44
Elderly primigravida (35 years of age or more)	39
Primigravida with breech presentation	35
Lack of progress during labor	33
Young primigravida (16 years and younger)	29
Previous cesarean section	20
Previous prolonged labor	19
Premature rupture of membranes, head high at term or early labor	14
Unmeasured pelvis in labor	11
Questionable presentation or question of multiple pregnancy	6
Previous small baby or twins	6

Distribution of Pelvic Inlet Types

We follow the inlet classification of Caldwell and Moloy. The first 228 cases surveyed, although statistically few, represent a fairly accurate cross section of the District of Columbia's population. Excluding the Negro patients, the cross section is fairly representative of the American population at large. This is due to the presence in this city of people from every state in the Union. It was found that pure gynecoid inlets were seen in but 22.8 per cent of the pelves studied. The next two most predominant inlet types were anthropoid posterior segment with gynecoid anterior segment 19.2 per cent, and pure anthropoid 16.2 per cent. The remaining pure, mixed, and asymmetrical types were widely diversified. Pure platypelloid and pure android inlets are rare, only 1.7 per cent and 1.3 per cent, respectively, were observed in this series. The remaining 500 inlets were not analyzed. It is our impression that they would have followed fairly closely the incidence as shown in Table II.

TABLE II. DISTRIBUTION OF PELVIC INLET TYPES, FIRST 228 CASES

	NO.	PERCENTAGE
Pure gynecoid	52	22.8
Gynecoid with android	15	6.6
Gynecoid with anthropoid	13	5.7
Gynecoid with platypelloid	15	6.6
Pure android	3	1.3
Android with gynecoid	3	1.3
Android with anthropoid	1	0.43
Android with platypelloid	0	0
Pure anthropoid	37	16.2
Anthropoid with gynecoid	44	19.2
Anthropoid with android	14	6.1
Anthropoid with platypelloid	5	2.1
Pure platypelloid	4	1.7
Platypelloid with gynecoid	11	4.8
Platypelloid with android	1	0.43
Platypelloid with anthropoid	7	3.0
Asymmetrical	3	1.3

Prediction of Outcome Versus Actual Outcome

Table III denotes the prognosis as given in this group of 700 patients. The predictions shown are brief but embrace considerably more than their

face values may indicate. In each case, adequate discussion is given under the rendered prognosis to permit the obstetrician receiving the report to appreciate fully why such recommendations are made. We reviewed our predictions and found that they compared fairly favorably with the outcome in the greater number of instances.

TABLE III. PREDICTIONS AS TO TYPE OF DELIVERY

PREDICTION	NO. OF CASES
Vaginal delivery anticipated	607
Cesarean section	33
If head not in pelvis in 6 to 8 hours of good labor, re-evaluate	40
If breech persists at onset of labor, advise cesarean section	4
If baby considered large clinically, consider cesarean section	2
If transverse lie persists at onset of labor, advise cesarean section	2
With good labor, should deliver vaginally; if poor labor, consider cesarean section	3
Fetus not visualized or too high to estimate disporportion	4
Too early to estimate cephalopelvic relationship	5

While vaginal delivery was predicted in 607 cases, actually 608 cases were delivered per vaginam. Cesarean section was advised in 33 patients. It was suggested that 40 of the patients be allowed a 6- to 8-hour trial of labor. If at the end of that trial, clinical evaluation demonstrated that progress was unsatisfactory, cesarean section was advised, In 6 patients cesarean section was advised if an abnormal position, namely, breech or transverse lie, persisted at the onset of labor. In 9 patients, pelvimetry was done too early, or the head was too high to estimate cephalopelvic relationship properly.

In the final analysis, 92 patients were delivered by the abdominal route (Table IV). Of these, 35 were elective procedures. The remainder were terminated by cesarean section after having had some labor. The average duration of labor among these patients was 20½ hours. The shortest was one hour and the longest was 96 hours.

TABLE IV. ACTUAL TYPE OF DELIVERY

Spontaneous delivery	212
Low forceps delivery	339
Midforceps delivery	22
Cesarean section	92
Breech delivery	32
Twin delivery	3

Three hundred thirty-nine patients were delivered by low forceps and 22 by midforceps. No analysis was made of the number of patients in whom forceps delivery was listed as the probable outcome. This was omitted because the frequency of outlet or prophylactic forceps would make the results invalid. However, it is hoped that in the future we may be able to learn more from patients who run into difficulty with midpelvic arrest.

There was one maternal death which was attributed to anesthesia. During the second stage of labor this patient apparently ceased breathing. "Postmortem" abdominal delivery was performed. The patient was revived, but lived for only two days. The infant was discharged in good condition.

There were 18 fetal deaths in this group of 700 labors. These include 5 deadborn, 2 stillborn, and 11 neonatal deaths. The uncorrected fetal mortality in this series is 2.5 per cent. This figure is essentially the same as the one for the over-all fetal mortality of the clinic which was 2.8 per cent in 1952.

Forty-eight mothers sustained temperature elevation of 100.4° F. for two or more days excluding the first day post partum. The largest group, 19 cases, followed cesarean section. There were 10 cases of morbidity after spontaneous delivery, 2 after breech delivery, and one occurred subsequent to midforceps delivery. This constituted a morbidity rate of 6.8 per cent.

Summary

Isometric pelvimetry as developed by Steele, McLane, and Javert is accurate. It subjects the mother and fetus to a minimum of inconvenience and of exposure to x-rays. The films are easy to mark, and skillful interpretation of them may be acquired within a short time. It cannot be too strongly emphasized that an obstetrician should be responsible for mensuration and interpretation of the films. If this were made a universal practice, the art of obstetrics when dealing with questionable pelves could be improved. The method of marking films and their interpretation are outlined.

Seven hundred consecutive unselected cases in which x-rays were taken are analyzed. The results are of interest even though the total number may not be large enough to be statistically significant. It is possible by this method to measure all the major diameters of the pelvis accurately. Individual measurements in themselves are not important unless integrated with other related diameters. An abnormally shallow posterior sagittal diameter of the midpelvis may be compensated for by a wide interspinous diameter, or a narrow intertuberous diameter may be similarly compensated for by a deep posterior sagittal diameter of the outlet. Cephalopelvic relationship is, however, of the utmost importance. The age of the patient, parity, and previous obstetrical history should be carefully weighed in the attempt to evaluate any pelvic series, and one must not judge the patient's management by the films alone.

We wish to thank Dr. Willy Baensch and the members of the Department of Roentgenology for their cooperation in adopting this method of pelvimetry. We also wish to thank Dr. A. A. Marchetti for his helpful suggestions in the preparation of this paper, and Mr. Bernard F. Salb for his excellent photography.

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EXPERIMENTAL PULMONARY ARTERIAL OCCLUSIONS: ACUTE COR PULMONALE SIMULATING "OBSTETRICAL SHOCK" OF LATE PREGNANCY*

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R. M. ENGSTROM, M.D., M.A.,*** ELOISE, MICH.

THE purpose of the present investigation is to study the acute right-sided heart failure that can be caused by disseminated fibrin embolism. Fibrin embolism was initiated by the injection of thromboplastin into the circulation of dogs. These injections induce shock[19-27] which is comparable to the obstetric shock of maternal abruptio placentae.[23]

Fibrin may also form quickly in the circulating blood[22-24] during the maternal pathologic disorder, abruptio placentae.[20-22] During this disseminated coagulation, the conversion of fibrinogen to fibrin may result in defibrination of the circulating blood[4, 15, 21] with consequent increased susceptibility to hemorrhage.[4, 15, 21] An even more immediate hazard exists. This hazard arises from the deposition of the fibrin, intravascularly[19-28]; there may be almost immediate interference with significant portions of the circulation.[19-27]

Of special interest to the present investigation, these intravascular occlusions from this "fibrin embolism" seem to lodge or to form predominantly in the pulmonary arterial tree.[20-23]

For purposes of a reference standard, intravascular occlusions of other kinds were induced experimentally in dogs by injection of several other materials. Special interest was directed toward the injection of meconium inasmuch as shock of experimental meconium embolism is the result of circulatory occlusion which involves the pulmonary arteriolar and capillary bed almost *exclusively*.[35] By contrast the intravascular occlusions of "fibrin embolism" appear to be formed preferentially and, at best only *preferentially,* in the pulmonary vascular bed.[10, 20-24] Because of the limitation of *meconium* embolism to the pulmonary vascular bed, study of this disorder provides a valuable control for the study of complications of *fibrin* embolism in which the occlusions may not be so precisely limited to the lesser circulation.

In fibrin embolism, not only may the fibrin also be deposited in vascular beds elsewhere in the body, but under selected conditions these occlusions also may be of serious consequences: if in a vital area, conceivably they may be immediately lethal,[19, 21, 32] or if in certain organs, such as the kidney or the pituitary gland, they may produce delayed injury.[10, 13, 21, 33] These secondary foci of intravascular occlusion are not of primary interest in the present investigation.

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Obstetric Shock.—The term "obstetric shock" first acquired specific meaning when Steiner and Lushbaugh[35] discovered and delineated the entity maternal pulmonary amniotic fluid embolism. In this disorder of late pregnancy, amniotic fluid enters the maternal circulation. If the amniotic fluid carries a significant burden of suspended debris, then innumerable small embolic masses may become disseminated throughout the pulmonary arterial vasculature. When this disseminated pulmonary embolism is massive enough, it may lead to such marked interference with the lesser circulation as to cause circulatory failure and shock[35]; death may occur acutely or after shock of some hours' duration.[35]

The morbid physiologic processes of "obstetric shock" in human amniotic fluid embolism are difficult to study not only because the disorder itself is rare, occurring once in some thousands of obstetric deliveries, but also because the diagnosis is not always entertained clinically, and even then, cannot be proved ante mortem.

The comparable "obstetric shock" which may develop in abruptio placentae,[21, 22] while not common, is yet not rare, occurring in severe degree once in some hundreds of obstetric deliveries. Because in abruptio placentae perhaps even more than in amniotic embolism the shock may be further prolonged and intensified as a result of hemorrhage, there has been a long-standing tendency to regard the underlying or initial pathogenesis of the shock as one of simple hemorrhage rather than shock peculiar to pregnancy.

Occlusions of the pulmonary arterial circulation by fibrin deposits, which could be the cause of such shock, have been demonstrated in postmortem tissue sections of some women who die of abruptio placentae,[22] in the pregnant rabbit following experimental placental trauma,[20] and in experimental animals after intravascular injection of thrombin,[10] or of thromboplastin,[36] including thromboplastin from the placenta or from the decidua.[19-21]

Because of the comparable distribution of the vascular occlusions throughout the lesser circulation, the question has arisen[23] whether the mechanism of circulatory failure that is primarily operative in meconium embolism, namely, acute dilatation of the right side of the heart,[35] may act in essentially the same manner, and thereby cause the known, acute circulatory failure of abruptio placentae.

Comparison of the Vascular Occlusions.—Intravascular occlusions of experimental meconium embolism are noncoagulative[27] and are embolic in the sense of being already formed, before they become released into the circulation.[27, 35] Within a short interval, coagulation becomes so markedly inhibited[27] by release of heparin[28] that the blood will not coagulate at all,* just as it may be completely incoagulable in human amniotic embolism.[3, 17]

*Dominguez has observed "fibrin thrombi" in a proved case of amniotic embolism.[7] Upon examination of the tissue sections, kindly provided by Dr. Dominguez, these minute occlusions[7] lack the peculiar structure of the fibrin plugs of "fibrin embolism."[22] Phosphotungstic acid stains failed to demonstrate the presence of fibrin; this, of course, does not necessarily exclude the presence of fibrin. Neither could formation of the occlusions by massive agglutination of platelets be confirmed or excluded, the specificity between the Schiff reagent and platelets being even less than that between phosphotungstic acid and fibrin.

By contrast, the intravascular occlusions of abruptio placentae tend to be built up in situ[22] by incremental fibrin deposition. There can be little doubt that this fibrin deposition is the result of formation of disseminated submicroscopic fibrillae of fibrin, throughout the entire circulating blood, with coalescence of these into larger aggregates.[23] Partly on the basis of such minute embolism, the actual observation[19, 36] and interpretation[19, 21, 36] of which still deserve considerable investigation, the underlying process has been referred to as "fibrin embolism."[22]

Further reason for the choice of the term "fibrin embolism" arises out of comparison with amniotic embolism.[35] Generally, in amniotic embolism there are vascular occlusions by amniotic debris, and not occlusions by fibrin deposition.[35*] Conversely, in at least some women, dead of abruptio placentae, microscopic occlusions of size comparable to the occlusions of amniotic embolism, but made up of fibrin, are present in the pulmonary vascular bed,[18, 22] if not also in other organs.[13, 18, 22, 33] The interpretation has been presented that the *acute* circulatory failure that is sometimes observed in abruptio placentae and in some cases of eclampsia may be in large part caused by such acute obstruction of the pulmonary circulation, perhaps with development of clinically recognizable acute cor pulmonale[37] or with pathologically recognizable acute dilatation of the right side of the heart.[23]

There seems to be fibrin embolism in at least some cases of eclampsia.[13, 18, 24] In association with amniotic embolism also, convulsions are sometimes observed clinically[3] or there are pathologic findings[35] suggestive of eclampsia.

In contrast to these views on obstetric shock, Scott does not make reference to pulmonary vascular occlusions at all.[31] Sheehan has observed thromboses in certain organs, but, in the lesions that he studied, he found evidence leading him to presume that these were secondary to focal necrosis, rather than the cause of it.[33] McKay and associates interpret the fibrin deposits as thrombi and suggest still another attractive pathogenetic process.[13]

The observations of functional changes of the circulation during fibrin embolism induced experimentally in dogs, which are presented in the following studies, are consistent with the interpretation of disseminated intravascular obstruction of the lesser circulation, with pulmonary hypertension and acute cor pulmonale. Independent evidence of acute cor pulmonale, namely, that of the electrocardiogram, is to be presented elsewhere.[1]

Methods

Experiments were carried out on dogs under Nembutal anesthesia. Besides animals that were used for related studies, 35 dogs were used specifically for the studies reported here. Frequently the surviving animals were injected again with the same or with different materials, either at once or after a short recovery period, for studies of "crossed" refractoriness. In each experiment the material was injected rapidly from a syringe, intravenously, as a single dose. Crude bovine lung extract was used as a source of thromboplastin.

*Dr. Paul Steiner has re-examined tissues of amniotic embolism and confirms his statement[35] that fibrin deposits are not found in amniotic embolism.

Usually not more than one category of observation was made on any given animal. This was not only because of technical complexities inherent in simultaneous recordings, but because of mutually exclusive disturbances introduced by the different procedures. For example, during intravascular catheterization, disturbances of coagulation caused by trauma from the catheters themselves, as well as disturbances from the surgery incidental to the catheterization, would have rendered precise studies of blood coagulation unreliable. Likewise, separate animals were used for direct observation of right-sided cardiac dilatation. For electrocardiographic recordings,[1] an entirely additional series of animals was used.

For the blood pressure recordings of the present observations, a semiflexible, polyethylene plastic catheter of 2.5 mm. outside diameter, introduced via the right jugular vein, was passed through the right side of the heart, and into the pulmonary arterial trunk. The catheter was open at the end and had an additional side opening 2 mm. from the tip; it was connected to a mercury manometer. From a floating indicator on the mercury, a kymograph recording of the arterial pressure was made on a smoked drum.

The insertion of the catheter into the pulmonary trunk was carried out by trial and error; the placing was evaluated by observing the changes of pressure in the manometer. To make small changes of pressure more evident, a water manometer was attached by a side arm to the mercury manometer. Entrance of the catheter into the right side of the heart was confirmed by an increased fluctuation of the pressure with each heart beat, and by an increased average pressure. Upon passage into the pulmonary trunk there was a considerable rise of pressure.

Particularly with small dogs, it was not always technically possible to introduce the catheter readily into the pulmonary artery by the method described. A common difficulty was that the tip of the catheter tended to become engaged in recesses between the trabeulae carneae of the right ventricle, impeding further passage. In such instances, the thorax was opened in the midline, and, by manual manipulation through the cardiac wall and the intact pericardium, the catheter was guided through the right ventricle and into the pulmonary trunk. While the thorax was thus opened, it was, of course, necessary to administer artificial respiration under positive pressure. The position of the tip of the catheter in the pulmonary trunk was confirmed by palpation and was adjusted accordingly. The thorax was then closed with clips and the animal was allowed to establish its own respiration and to stabilize its blood pressure before the experimental injection.

In order to minimize the risk of plugging of the catheters by coagulation of blood within them, the catheter system was filled with 2 per cent sodium citrate solution. Controlled inflow of this anticoagulant was permitted as needed through a side arm, under a pressure somewhat in excess of the greatest experimental pressure that was usually to be anticipated. The side arm consisted of a needle that pierced the catheter in the direction toward the animal; within the catheter, this needle was engaged into a 10 cm. length of a second plastic tube of a diameter less than the inside diameter of the primary recording catheter itself. The resistance to flow between these concentric layers of tubing tended to minimize reflux of blood into the catheter during sudden, transitory changes of pressure. Owing to this and to the combined damping effects of the various connecting portions of rubber tubing, as well as the damping effect of the mercury manometer, the pressure recordings obtained were essentially mean arterial pressures.

A similar, doubly concentric catheter was used to measure the systemic arterial pressure. This catheter was introduced via a femoral artery and was passed into the abdominal aorta.

During intervals when the pressure was rising in either circulatory system, the tendency for reflux of blood into the catheter was counterbalanced by momentary releases of citrate, the total volume of citrate being held to a minimum. Comparable, or larger, test doses of citrate during control observations caused no remarkable effect upon the blood pressure.

At the end of each experiment, the dog was sacrificed and the position of the tip of the catheter was confirmed by direct palpation at postmortem examination.

Results

Meconium Embolism.—The effects of a barely lethal dose of meconium upon the pulmonary, and upon the systemic, blood pressures are shown in Fig. 1. The pressure changes were essentially instantaneous. It can be seen that the pulmonary pressure increased to 50 mm. of mercury and the aortic pressure decreased, simultaneously and as the mirror image, to a shock level. The pulmonary arterial pressure was maintained at a high level for some time, even during continued systemic shock of meconium embolism.

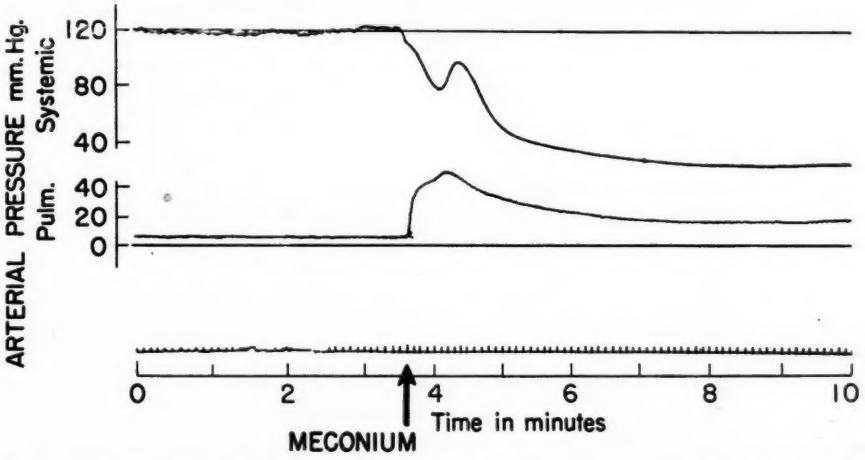

Fig. 1.—Pulmonary and systemic arterial blood pressure changes following a lethal dose of meconium suspension injected intravenously into a dog. The pulmonary arterial pressure began to rise at once and reached a maximum of about 50 mm. of mercury within 30 seconds. The aortic pressure simultaneously fell to shock levels.

After a dose, barely *sub*lethal, of meconium suspension, the initial blood pressure changes were almost as severe as after a lethal dose. Gradual recovery followed; the systemic pressure tended to recover soon and over an interval of an hour or longer there was gradual regression of the pulmonary arterial pressure toward normal.

The effects of small doses of meconium suspension, both upon the pulmonic and upon the systemic arterial pressures were minimal, if detectable at all.

Fibrin Embolism.—The effects of fibrin embolism upon the pulmonary and systemic arterial pressures are shown in Fig. 2. Just as with meconium embolism, there was a rise of pulmonary arterial pressure to a markedly hypertensive level of 50 mm. of mercury. Coincidental with, and as a mirrored image of this, there was a decrease of the aortic pressure to shock levels (Fig. 2).

As indicated by the broken line in Fig. 2, if the dose of tissue extract was a lethal one, the systemic pressure continued to fall.

Following a barely sublethal dose of thromboplastin, initial pressure changes similar to those of lethal doses occurred; then the aortic pressure

began to rise again and, within four or five minutes after the injection, the pressure was restored essentially to its initial level or as in the experiment of Fig. 2, the pressure even rose well above the initial level. Such restoration of the systemic pressure could occur even though the pulmonic pressure remained somewhat above normal.

During the peripheral hypotension, the pulse in the femoral artery was frequently not palpable at all or only after surgical exposure of the artery. In some instances not only the catheterized femoral artery, but the opposite one as well was exposed surgically. After the injection, the artery contracted to half its usual diameter.

Upon subsequent recovery of the systemic pressure, the femoral artery seemed to remain at least partially contracted for some time. In view of the restoration of the systemic pressure in the presence of an apparently contracted peripheral arterial vasculature, it is possible that there may have been a decreased cardiac output. Although actual measurements of cardiac output would be of much interest, these have not been carried out.

Following small doses of thromboplastin extract, the effects upon either the pulmonary or the systemic arterial pressure were less pronounced and were transitory or were even not significant.

As can be seen in Fig. 2, one minute or more was required to develop the pulmonary hypertensive changes after thromboplastin injection. This is in marked contrast to the almost immediate pulmonary hypertensive changes after meconium embolism (Fig. 1).

Similar reactions occurred upon initiation of fibrin embolism by the injection of thrombin, although even more acutely. In order to avoid lethal reactions, the thrombin was injected slowly, as though titrating the animal. This was best accomplished by an intravenous drip.

Right Ventricular and Venous Pressures.—In some experiments, right ventricular pressures, rather than pulmonary arterial pressures, were recorded. The changes were comparable to those from pulmonary arterial recordings, but were of lesser magnitude, maximal mean pressures being of the order of 25 mm. rather than 50 mm. of mercury. In some preliminary experiments, venous pressures were recorded; the pressures increased from control, preinjection levels of 15 to 18 mm. of water to as much as 38 mm. after injection of meconium or of thromboplastin.

Kaolin Injection.—When a 1:10 suspension of kaolin was injected intravenously, doses greater than 1 ml. per kilogram of body weight were lethal. Pulmonary hypertension and systemic hypotension followed. After a barely lethal dose of kaolin, two to three minutes were required to reach a maximum pulmonary arterial pressure of 50 mm. or more of mercury. With massive overdoses, the effect was more rapid.

In one animal a dose of only 0.8 ml. per kilogram was given. In this animal, there was partial temporary restoration of the aortic pressure within three minutes, followed by a short interval of marked systemic hypertension, then final circulatory failure and death. After doses that were quickly lethal, the blood was coagulated in the great veins, arteries, and heart.

Agar Injection.—Finely powdered agar, suspended in saline, but not converted to a gel by heating, was injected intravascularly into two dogs. A 1:10 suspension of the agar was allowed to stand until the larger particles had settled out; the supernatant, still-turbid fluid was decanted and was used for the injection. The responses of the blood pressures of the animals were similar to those after injection of kaolin, with increased pulmonic and decreased systemic, arterial pressure. After a dose that was quickly lethal, the blood in the large vessels and in the heart was coagulated throughout.

Reaction to Transfusion of Incompatible Erythrocytes.—When large doses (3 to 5 ml. per kilogram) of human blood or of washed human erythrocytes, resuspended in saline, were injected rapidly into dogs, pulmonary hypertension and aortic hypotension followed. The pressure changes were not as extreme as with the other agents used, and usually the pressure soon returned to normal.

Clinical Reactions of the Animals.—Within 15 to 30 seconds following injection of a lethal or near-lethal dose of thromboplastin, there was usually an interval of apnea, followed at 30 to 50 seconds by labored respiration, or if the dose had been a lethal dose, there was little or no return of regular respiration, there being only sporadic gasping. Even before the respiratory changes, there was failure of the peripheral pulse; however, the apex beat of the heart, meanwhile, was especially forceful. In summary, the course of events following a lethal dose, was: first, failure of the systemic pulse; second, failure of respiration; and, last of all, cessation of the heart beat.[19] A similar series of events followed injection of thrombin.

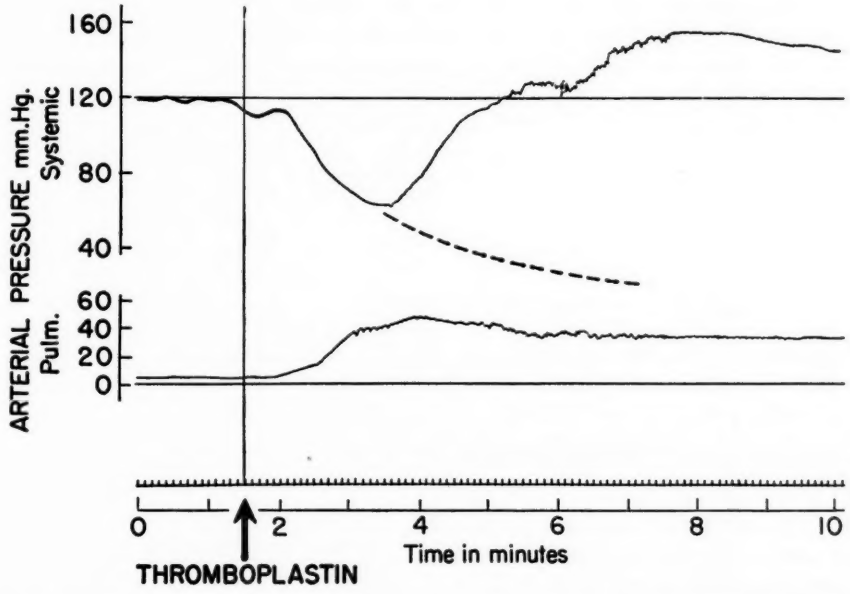

Fig. 2.—Blood pressure changes following a nearly lethal dose of thromboplastin extract. After a 30 second lag, the pulmonary pressure began to increase slowly at first, then more rapidly for the first minute and reached a maximum of 50 mm. of mercury at two and one-half minutes. The aortic pressure changed as a mirror image of the acute pulmonary hypertension reaching a shock level of 60 mm. of mercury at two and one-half minutes. Thereafter recovery followed with restoration above the initial level of 120 mm., and up to 150 mm. of mercury, within 6 minutes after the injection.

The usual course of the systemic pressure following a lethal dose of thromboplastin is indicated by the broken line.

Death supervened more rapidly after injection of a large dose of meconium than after a large dose of thromboplastin.

The reactions after injection of kaolin, of agar, or of mismatched erythrocytes, varied with the dose and usually required more than one minute.

During a severe reaction, or terminally, there was usually incontinence of feces and of urine. At autopsy there was splanchnic pooling of blood: engorgement of the vessels of the viscera, distention of the liver, and usually of the spleen. This is in contrast to the reaction in peptone shock, in which the pooling of blood is believed to be in the peripheral capillary bed.

When the dose was sufficient to cause a severe but not lethal reaction, coarse respiratory râles appeared. Acutely, after the injection of lethal or near-lethal doses, the enlargement and turgidity of the liver were usually sufficient to be readily palpable through the abdominal wall.

Injection of Platelet Extract.—Highly purified bovine platelet preparations were obtained in large quantities.[30] Crude saline extracts of these platelets were made.[30] The "extracts" were actually suspensions of platelet materials and platelet debris. These suspensions have been found to be highly active in initiation of coagulation in the test tube.[9] As will be reported elsewhere,[29] however, these same extracts have no effect upon coagulation of the circulating blood when injected intravascularly.

It does not follow, however, that the platelet extracts are without effect upon the circulation itself. Indeed, upon intravenous injection, both the pulmonic and systemic blood pressures increased at once so markedly as to force blood upward into the irrigation reservoirs themselves of both catheter systems; the blood then coagulated in the catheters and plugged both systems. The pulmonary pressure had exceeded 60 mm. of mercury and the systemic pressure had exceeded 300 mm. of mercury. This generalized hypertensive response was interpreted as being a response to the platelet vasopressor substance, serotonin.[16]

No evidence was found of acute cor pulmonale, either as determined by the methods employed above, or by electrocardiographic methods.[1]

An apparent response of acute cor pulmonale could be induced by intravenous injection of a *massive* dose of the debris itself from crude platelet extracts. In order to minimize the influence of serotonin (a crystalloid molecule, 5-hydroxy-tryptamine), the debris was washed three times with saline before injection. When the debris from 6 ml. or more of packed platelets was injected into a 12 kilogram dog, signs of circulatory and respiratory embarrassment appeared, sometimes ending in death after an interval. This dose corresponds to the debris of three times as many platelets as are normally present in the dog's entire circulation (or making allowance for differences of size of platelets, approximately equal to the debris of the total mass of platelets of the dog's own circulation). The effect of this large mass of washed platelet debris in causing acute cor pulmonale is comparable to the effect of similar large masses of other kinds of debris. There is no need to invoke special activities of coagulation or of serotonin under these conditions; the debris itself, in the sense of any debris, was adequate to account for the cor pulmonale. Hence the acutely transitory effect of injection of an ordinary dose of crude platelet extract into the circulation, or of clarified platelet extract, is probably not an effect of coagulation or of embolic debris, but largely an effect of acute, widespread arterial vasoconstriction.

Peptone Shock.—Peptone shock was induced in two dogs (5 per cent peptone in saline, 250 mg. per kilogram of body weight). In order to obtain a severe and sustained effect, it was necessary to give this as a single infusion or single injection. The aortic pressure then fell quickly to a shock level of 40 mm. of mercury and recovered only slowly. The pulmonary arterial pressure gradually rose from 10 mm. to 14 mm. of mercury. This small rise of pulmonary arterial pressure, in contrast to that following injections of other materials, occurred *after* the fall of systemic pressure. This small, delayed change is one that would be expected on the basis of circulatory reflexes. There is no necessary implication that the mechanism of peptone shock is the same as that caused by the various kinds of pulmonary circulatory occlusions under consideration here.

Effects on Coagulation Mechanism.—Separate analyses, on plasma from dogs, not to be reported here, confirmed that after injection of near-lethal doses of thromboplastin but with survival, the circulating fibrinogen almost disappeared,[4, 15] and the plasma Ac-globulin[8] largely disappeared. Under near-lethal conditions, prothrombin decreased by one-half and the platelets by one-half.[15, 23] The drawn blood did, however, coagulate, and this with a normal or not greatly prolonged coagulation time.

As noted previously[27] for blood from patients with abruptio placentae, so also the blood or plasma from dogs injected with thromboplastin, even in the presence of an anticoagulant, when stored in the cold or upon thawing after freezing, tended to form a small coagulum of fibrin. Only after repeated injection of prolonged, large doses of thromboplastin or better yet, after a final injection of thrombin, did the fibrinogen of the coagulation mechanism appear to be completely exhausted.

By contrast, after injection of meconium, the plasma components of coagulation remained unchanged.[27] In meconium embolism, the circulating blood became totally incoagulable, i.e., drawn blood did not coagulate within twenty-four hours. The blood contained an inhibitor[27] demonstrated to be heparin.[28]

The disturbances of coagulation after injection of kaolin or of agar were not well characterized. After injection of sublethal doses of kaolin, there was some depletion of fibrinogen and of plasma Ac-globulin. The protamine titration under these conditions was not applicable, for the same reason that it was not applicable after thromboplastin injection, namely, that the coagulation mechanism was either already activated or was depleted to a variable degree, so that no reliable control value could be established. Heparin assays were not made.

Tolerance to Multiple Injections.—When an animal survived an injection, a second or even a third injection was sometimes given at intervals of approximately one-half hour.

When such secondary injections were given, the animals were usually refractory to the succeeding doses, i.e., they could survive doses somewhat greater than the usual lethal doses. With respect to succeeding doses of the same agent, this acquired tolerance developed to stepwise increasing dosage of thromboplastin or of thrombin, finally with complete refractoriness. Tolerance also developed to a considerable degree after stepwise injection of doses of peptone.

Increased tolerance or refractoriness was also found to serial injection of different agents after one another. The refractoriness could be essentially complete to thrombin, or to thromboplastin after primary injection of either one of these. Tolerance was partial, but not complete, to kaolin and to agar after a primary injection of thromboplastin. The tolerance to kaolin, to agar, and to thromboplastin, increased markedly after peptone. Refractoriness to meconium after a primary injection of meconium or after other materials was not always demonstrable.

Although the components of coagulation were not altered by the injection of peptone or of meconium, the induced refractoriness to thromboplastin thereafter was often quite pronounced, preventing a lethal reaction. Neither did the thromboplastin then induce clinical changes; there was little or no pulmonary hypertension and no electrocardiographic changes suggestive of acute cor pulmonale appeared under these conditions; secondary injections of an initiator of coagulation could induce morbid changes only if the dose were a supralethal, or a markedly supralethal dose.

Cardiac Dilatation.—When the heart was exposed surgically, distention of the right auricle and ventricle could be observed as it developed after injection of a lethal dose of meconium or of thromboplastin. At the same time, the left chambers of the heart failed to fill adequately.

When, in addition, the pericardial sac itself was incised or removed surgically before the injection was given, the distention of the right side of the heart was even more extreme.

Artificial Respirations.—In some experiments, the meconium or thromboplastin was injected while the chest was still opened surgically and while artificial respiration was being administered by endotracheal catheter under positive pressure. Usually a somewhat wider respiratory excursion was given than would have been normal for the animal's own respiration. Under these conditions the animals did not die from ordinary lethal doses but remained alive, at least for the succeeding hour of the observations. Similarly, after the chest had been opened and then closed surgically, if artificial respiration was maintained by positive pressure with a relatively wide pulmonary excursion, the animals were protected against ordinary lethal doses. If, however, after the chest had been closed, the animal was first allowed to re-establish its own respiration before injection of meconium or of thromboplastin, then a lethal dose was fatal as in any animal under its own respiration. If artificial respiration under positive pressure was carried out on a dog of which the chest had never been opened, that animal was then relatively protected against a lethal dose of meconium or of thromboplastin.

Comment

The present observations were made upon animals into which single massive injections were given. Exploratory experiments confirm that even more profound responses can be induced by properly spaced, repeated injections, or perhaps even by a continuous intravenous drip. It may be significant that the autoextraction of tissue materials into the maternal circulation during abruptio placentae[22] may follow an intermittent pattern.

Anaphylactoid Shock.—Concerning maternal amniotic embolism, Steiner and Lushbaugh,[35] despite the finding of widely disseminated, minute embolic vascular occlusions, and of postmortem findings of right-sided heart failure, were of the impression that the quantity of embolic debris was not sufficient, in itself, to cause sufficiently extensive vascular obstruction to account for the shock either of human amniotic embolism or of experimental meconium embolism. They believed that there must be an additional causative factor to account for circulatory obstruction and suggested a pulmonary arteriolar spasm.[35] In the previously mentioned experiments, marked hypertension resulted from injection of platelet extracts. This was probably due to the platelet vasoconstrictor material, serotonin. This appears to provide a plausible source for an appropriately active mediator of vasospasm not only during abruptio placentae but also during amniotic embolism.

Steiner and Lushbaugh[35] applied a generic term, anaphylactoid shock, to the over-all clinical condition of severe amniotic embolism. They employed the term anaphylactoid shock in the same sense as it was used by Hanzlik and Karsner,[6] to imply a clinical similarity but a pathogenetic difference from anaphylac*tic* shock. Karsner and Hanzlik studied anaphylac*toid* shock as initi-

ated by intravenous injection of a wide variety of chemical and physical agents. Gross and Brown[5] delineated a precise role of a physical agent, particulate clay, especially when so finely divided as to be invisible microscopically, in the formation of widespread obstructions of the pulmonary vascular bed. In this kind of anaphylactoid shock,[5] the foreign material at once becomes coated with plasma proteins,[5, 12] with coalescence to larger masses[5] which cause pulmonary vascular obstruction. Some other possible contributing mechanisms of shock concerning vascular sphincters in different circulatory beds might also be considered.[11] The present investigation concerns itself with the type of anaphylactoid shock that is based primarily upon anatomic occlusions of the lesser circulation either by meconium embolism or by fibrin embolism, but not primarily with the well-known kind of anaphylactoid shock that can be induced by peptone alone, or by an agent such as benzene.[34]

Acute Cor Pulmonale.—In the previously mentioned experiments, the development of acute cor pulmonale following injection of thromboplastin or of thrombin is verified by more than one kind of observation. The signs, failure of the peripheral pulse with arterial vasospasm but with the heart still contracting forcefully, and distention of the liver, were present in anesthetized animals and also (in earlier experiments) in nonanesthetized animals. During the shock and at postmortem examination, the chambers of the right heart were markedly dilated. Marked pulmonary hypertension of onset at the same time as peripheral hypotension was demonstrated by kymographic recordings. Finally,[1] electrocardiographic changes consistent with acute cor pulmonale were demonstrated. Together these findings establish the diagnosis of acute cor pulmonale in the animals.

As with previous experiments, after single, rapid intravenous injections of tissue extracts,[19, 36] the experimental animals either died quickly or recovered within a few minutes. It is noteworthy that, in the animals that recovered, the pulmonary hypertension (above) and the electrocardiographic changes[1] of acute cor pulmonale were as transient as the clinical manifestations. Under the conditions of these experiments then, acute cor pulmonale, not subacute cor pulmonale, was the finding.

With respect to this transient nature of the acute cor pulmonale in the animals after survival from a single dose of thromboplastin, it is of interest to consider the mechanism of the early circulatory recovery—recovery that occurred within a few minutes and was apparently complete long before an hour had passed. Speculation as to the mechanism of onset of the pulmonary hypertension, and as to the recovery from it may take different directions.

Disseminated Intravascular Coagulation.—The disseminated vascular occlusions of fibrin which, during fibrin embolism, were presumed to be responsible for the pulmonary hypertension are sufficiently persistent to be demonstrable in tissue sections if the animals are sacrificed at once,[20, 21, 36] yet sufficiently ephemeral to have essentially disappeared if the animals survived one day.[20, 36] These results[23] suggest that the deposits are soon removed by fibrinolysis. Consistent with these observations, the marked fibrinolytic ac-

tivity in the shed blood of certain patients with abruptio placentae[14, 22, 38] may provide a mechanism for the removal of fibrin deposits, and thus, for the early relief of vascular obstruction in this maternal disorder. The rapidity of readjustment of circulatory pressures (Figs. 1 and 2) appears to be rather rapid to be readily explained by fibrinolysis alone.

Vasospasm and Platelet Vasoconstrictor.—During the recovery phase there was sometimes a systemic hypertension (Fig. 2) and, at least from gross observations, a continuing arterial vasoconstriction. These observations lead to the question whether an arterial vasoconstrictor agent may have played some significant role. The results are as though peripheral arterial pressure had been maintained, or augmented, even in the presence of an apparent decreased return to the *left* side of the heart. A potent vasoconstrictor, perhaps serotonin,[16] may have been released from platelets during the intravascular coagulation. Conceivably serotonin may have played the role of vasopressor agent in sustaining the peripheral pressure. Comroe, Van Lingen, Stroud, and Roncoroni find evidence of an even more striking role of serotonin in the production of acute cor pulmonale and other cardiac disorders.[39]

After experimental injection of each of the agents previously discussed, there was considerable decrease of the number of circulating platelets.[27] It is possible, therefore, that some platelets may have been lysed or sequestered out of the circulation, perhaps to release vasoconstrictor locally, and that these may have contributed to transitory hypertension, either pulmonary or systemic.

Release of such a vasoconstrictor may have played a role both in the production, and in the early decline of the pulmonary hypertension. If the platelet vasoconstrictor were released during intravascular coagulation and during the deposition of fibrin, then this vasoconstrictor might have contributed to vasospasm of the pulmonary arterial vasculature. In experiments not reported here, it was confirmed that isolated circular strips of pulmonary artery from the dog were responsive to the platelet vasoconstrictor, although less so than were strips of the carotid artery. Since serotonin is inactivated during circulation through the lung,[16] the action in the circulating blood, even of large amounts of such platelet vasoconstrictor, would presumably be of short duration. With early inactivation of the platelet vasoconstrictor, conceivably a vasopressor support to the pulmonary hypertension itself would be soon eliminated, and this could provide at least one mechanism for early decrease of the pulmonary hypertension. Such relaxation of the pulmonary arterial tree might in turn permit renewed blood flow around and past the fibrin deposits. Whether, in addition, the functioning of collateral vascular pathways may serve to relieve the pulmonary hypertension, can only be conjectured. It is sufficient at this time to recall that a potent vasopressor agent may well be released from platelets during intravascular coagulation, and that under critical conditions, conceivably this may play a multiple role in the production and in the decline of hypertension, not only pulmonary but also systemic.

Refractoriness to Subsequent Injections.—That several of the agents, in large doses, induced refractoriness to a secondary injection of the same or of a different agent may possibly have been related in some way to partial depletion of the available platelets. In addition, depletion of fibrinogen and conceivably of other agents of coagulation may have played a role in some of the reciprocally induced refractory states, fibrinogen being significant not only to those agents that caused intravascular coagulation, but in some way also to the coating and phagocytosis of foreign particles.[12] Such coated particles of kaolin or of clay[5] and presumably of other materials may coalesce into masses large enough to lodge in the pulmonary arterial tree.[5] Conversely, depletion of fibrinogen may conceivably interfere with coating and coalescence of such particles, and hence interfere with intravascular occlusion.

In contrast, after induction of shock by a primary injection of peptone or of meconium, the refractoriness to secondary injections of thromboplastin or of thrombin and perhaps as well to injection of kaolin or of other substances may be explained in quite another way, namely, that during meconium shock the blood was rendered incoagulable by the release of heparin.

High concentrations of heparin also cause not only inhibition of coagulation but also inhibition of the blood-sludging phenomenon[12] and inhibition of the coating of foreign particles in the blood stream by plasma proteins.[12] Release of heparin during the shock of meconium embolism may thus account not only for a considerable degree of tolerance to thromboplastin, but also for a tolerance to subsequent injection of foreign particles such as kaolin.

Margin of Safety and Recovery.—The animals demonstrated a remarkable margin of safety to injection of thromboplastin. Even after intravascular occlusions so widespread as to cause almost total failure of the circulation acutely, still early recovery was possible. Even after acute intravascular coagulation, sufficient essentially to defibrinate the circulating blood, there was some mechanism which acted to prevent total occlusions by the fibrin for more than a brief interval, and some mechanism to remove the obstructions almost totally within less than one day. Even after development of acute cor pulmonale of such severity that the peripheral pulse was imperceptible, recovery occurred within a few moments.

It is in relation to this considerable margin of safety that our management of obstetric shock in abruptio placentae must be planned. If we can but keep the patient alive for a short time, and prevent recurrent episodes of progression of the abruptio placentae, we have a good prognosis. In obstetric management, we can prevent recurrent episodes of progress of the abruptio placentae by early removal of the products of conception.[21-27] In supportive management, we can help sustain life during the brief episodes of obstetric shock by the mediel adjuvants, and, if hemorrhage supervenes, by appropriate but cautious use of transfusion. Artificial respiration with positive pressure, with a relatively wide respiratory excursion, maintained life in the experimental animals so successfully that they survived not only ordinary lethal injections of thromboplastin, but, at least for the interval of observation, also

survived ordinary lethal injections of meconium suspension. By comparison, combined advantages in the emergency treatment of obstetric shock of abruptio placentae and of amniotic embolism, above and beyond those of mere support of respiration, may well accrue from positive pressure, artificial respiration. This may suffice to preserve the patient for the brief interval until she can again adequately carry out her own functions, or until more specific measures can be taken to favor such spontaneous function.

Summary

Acute and extensively disseminated occlusion of the pulmonary arterial vasculature was induced in dogs by the intravenous injection of thromboplastin extracts. This causes massive initiation of coagulation throughout the circulating blood. The fibrin is known to be deposited in sufficient quantity to build up microscopically demonstrable intravascular occlusions; these have a predilection for the pulmonary arterial vasculature. Shock results from the interference with the lesser circulation. In the present studies with dogs, blood pressures were recorded through catheters introduced, respectively, into the pulmonary trunk and into the abdominal aorta. Pulmonary hypertension up to readings of 50 mm. of mercury, acute dilatation of the right side of the heart and electrocardiographic changes suggested that the circulation through the lungs had been markedly impeded and acute cor pulmonale induced. Control experiments with injection of different kinds of materials supported the hypothesis that tissue thromboplastin had indeed caused acute cor pulmonale. By contrast, after meconium embolism, there is an over-all inhibition of coagulation; here there were similar cardiopulmonary changes, but these were almost instantaneous. During initiation of fibrin embolism, one minute or more had been required before the blood pressure changes became severe, a time lag consistent with the time needed for building up of the fibrin occlusions. The animal experiments demonstrated that fibrin embolism may cause acute pulmonary hypertension and acute cor pulmonale. Conceivably, a platelet vasoconstrictor, serotonin, may be an important contributing chemical mediator in the production of the pulmonary and systemic hypertension. Since fibrin embolism occurs in maternal abruptio placentae, it follows that acute cor pulmonale may be a cause of the acute circulatory failure that is sometimes observed clinically in association with abruptio placentae, or in association with eclampsia. This would be comparable to the known acute cor pulmonale and dilatation of the right side of the heart, of maternal amniotic embolism. Transfusion may be essential for restoration of blood volume and in some instances for restoration of components of blood coagulation; it is important, however, to avoid excessive transfusion or infusion which may further overload an already embarrassed right side of the heart.

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DIVERTICULUM OF THE FEMALE URETHRA

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DIVERTICULUM of the female urethra, although known for many years, is too often undetected, and until recently has been considered a rare abnormality. The first report from this institution of diverticula of the female urethra appeared in 1941 when Engel[1] reported 6 cases. In 1943 Higgins[2] reported a diverticulum containing a calculus. Two years later Higgins and Rambousek[3] added 5 more cases. It is the purpose of this paper to bring this series up to date and to emphasize the clinical features of this condition. Since 1945, 33 more cases have been found making the total 45.

There has been considerable diversity of opinion regarding the etiology of urethral diverticula as indicated by Johnson,[4] Schmitz and Nelson,[5] Parmenter,[6] McMahon,[7] and others. Wharton and Kearns[8] reviewed the literature and pointed out some of the deficiencies in our knowledge regarding the embryology and anatomy of the paraurethral glands.

Lintgen and Herbut[9] have reported a study of 100 female urethras, and Huffman[10] graphically portrayed the anatomy of the paraurethral ducts and glands by means of wax reconstructions.

It is now generally agreed that the commonest sequence of events in the development of urethral diverticula (Fig. 1) is as follows: Infection of the paraurethral glands and ducts occurs (often secondary to trauma) followed by obstruction and abscess formation. Rupture of the abscess into the urethra occurs allowing free communication between the urethra and infected gland. Intermittent edema of the communication may produce recurrent obstruction with exacerbation of symptoms. There are a few instances of congenital cysts of the urethra which have been reported also.

The precise etiology is an academic question while the recognition and proper management of the abnormality is of primary importance.

Symptoms

Most patients with urethral diverticula have a long history because physicians often fail to recognize their symptoms. Since dysuria and frequency of urination are the two most common complaints, the majority of patients are treated repeatedly for what is considered to be recurrent urinary infections. These symptoms fluctuate in severity, increasing when the diverticulum is infected and distended, and decreasing when it empties. A few patients may experience dribbling of urine after voiding due to emptying of the diverticulum, and some have pelvic pain after urination.

Many patients notice a mass along the anterior vaginal wall. This mass varies in size from time to time and often is the cause of dyspareunia; when distended, dysuria and frequency are commonly noted. Some patients experience vague pelvic discomfort, such as a dragging sensation without any localizing symptoms. This bulge may also be entirely asymptomatic.

The duration of symptoms in our 45 patients ranged from 3 days to 25 years with the mean 2 years. Often they had seen many physicians and had been treated with antibiotics, urethral dilations, and other measures designed to relieve bladder symptoms. In some instances they had even been considered neurotic.

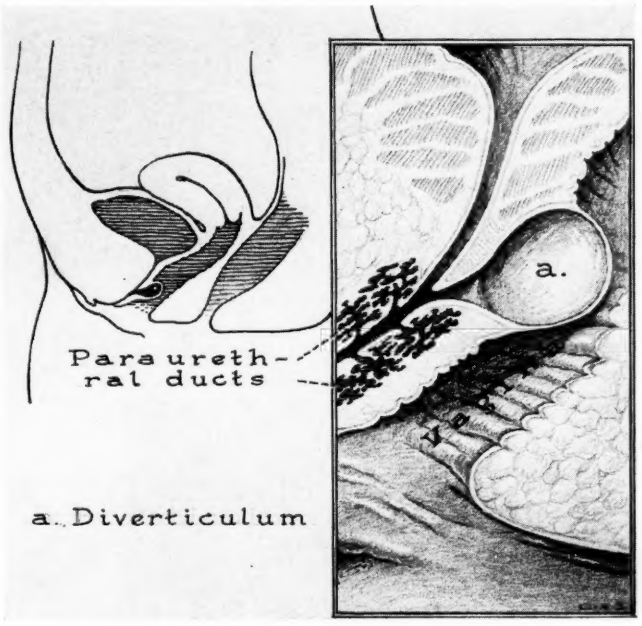


Fig. 1.—Anatomy of a urethral diverticulum.

Diagnosis

In order to make the diagnosis of urethral diverticulum, the possibility of its presence should be kept constantly in mind. Palpation of the anterior vaginal wall with particular attention to the suburethral area should be part of any thorough pelvic examination Thus, a rounded mass which is either firm or cystic and often tender can be detected. With pressure applied to the area, the urethral meatus should be inspected. If pus escapes from the urethra as the mass decreases in size, a diagnosis of urethral diverticulum can be made.

Sometimes no fluid can be expressed from the sac because the communication to the urethra is closed or the mass is so tender that pressure cannot be tolerated. Under these circumstances panendoscopic examination of the urethra, preferably under anesthesia, should be done. A search is made along the urethra for an opening into the sac. Usually a thin stream of pus can be seen

coming from the opening when a finger is pressed against the mass vaginally. Further inspection of the urethra and bladder may reveal additional urinary tract pathology.

Occasionally the history suggests the possibility of a urethral diverticulum when none can be found on examination, because it is collapsed and empty of all contents. Re-examination at the time of acute symptoms may then reveal the sac. Diverticula may be asymmetrical, because some are multilocular with the loculi extending up beside the urethra toward the symphysis pubis. Palpation of the urethra with an indwelling catheter or cystoscope is helpful in detecting diverticula and defining the extent of the sac. Saddle-type diverticula which straddle the urethra are sometimes encountered.

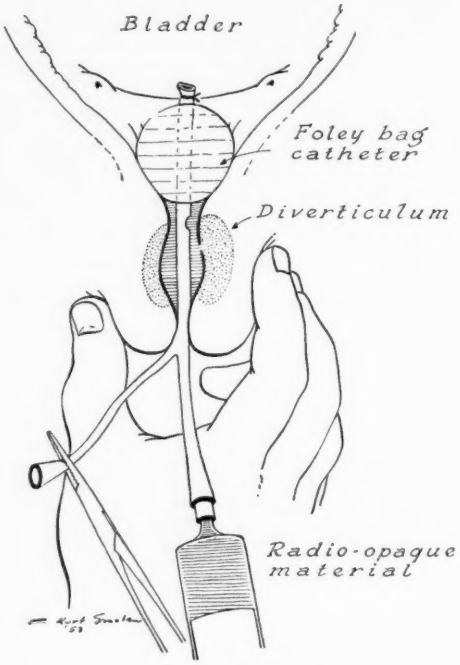
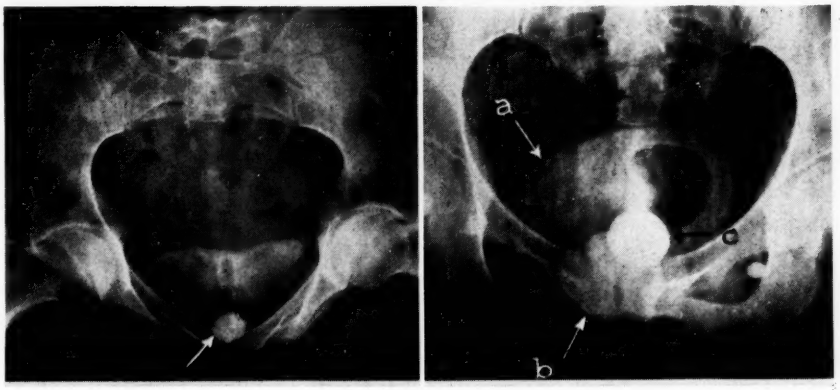


Fig. 2.—Catheter method of demonstrating a urethral diverticulum.

Roentgenographic demonstration of a urethral diverticulum is useful to confirm the diagnosis and determine the size of the lesion. In order to fill the sac without allowing the opaque medium to escape completely into the bladder, a simple device may be made from a standard 5 c.c. No. 20 French Foley catheter (Fig. 2). The nominal open end of the catheter is closed by means of a stout tie and a new opening is made into the catheter's lumen on the proximal side of the inflatable bag. The catheter is then inserted into the urethra and the balloon inflated in the usual manner. As the opaque medium is injected into the catheter, the balloon is pulled snugly against the bladder neck to prevent the fluid from entering the bladder. The new opening in the catheter allows the fluid to empty into the urethra where it may enter the diverticulum. An

x-ray picture is then taken when the diverticulum is palpably distended; generally a single anteroposterior film is sufficient. The material used has most often been dilute sodium iodide or Skiodan.

Ordinarily the diverticulum can be shown to consist of a single rounded sac extending below the urethra (Fig. 3, *A* and *B*). However, multilocular sacs are occasionally seen extending along the urethra toward the bladder neck (Fig. 4).



A. *B.*

Fig. 3.—*A*, Small solitary urethral diverticulum. *B*, Large urethral diverticulum (*b*); the bag (*c*) of the Foley catheter is filled with radiopaque material and pulled tightly against the outlet of the bladder (*a*).

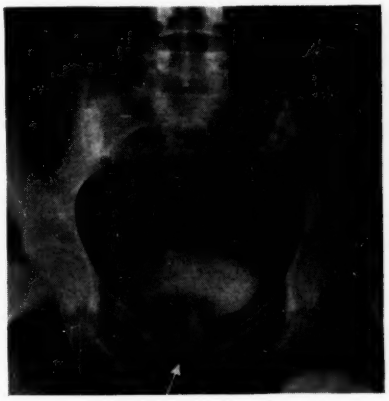


Fig. 4.—Multiloculated diverticulum.

Differential Diagnosis

There are several other lesions which occur along the anterior vaginal wall and, to avoid confusion, it is important to differentiate them from urethral diverticula. Gartner's duct cysts are common, symptomatic, and usually located lateral to the midline. They have no communication with the urethra. An adenoma of a urethral gland is rare and is usually movable, firm, and not tender. An adenocarcinoma may also develop in this same area, and it is also possible for metastases in generalized carcinoma to appear in the suburethral area. There are two reports of carcinoma arising in a diverticulum of the female

urethra.[11, 12] A urethral abscess is extremely tender and is considered to be a stage in the development of a urethral diverticulum. Urethrocele, a poor term, refers to the downward protrusion of the urethra from its attachment under the symphysis pubis coincident with anterior vaginal wall relaxation. Many of the symptoms of urethritis are similar to those caused by a urethral diverticulum, but no swelling is palpable along the vaginal wall. Swelling may be present in the first stage of the development of diverticula.

Treatment

Some patients having urethral diverticula are asymptomatic and require no treatment. In these instances the urethral communication is large enough to provide adequate drainage of the sac. Eight of our patients have practically no symptoms related to the diverticulum and need no surgical therapy, but are observed periodically. Various types of therapy were unsuccessfully attempted for a number of the patients with symptoms. Antibiotics and chemotherapeutic agents will not cure the lesion and have proved ineffective in relieving infection often encountered prior to operation. Urethral dilations and manual expression of the sac may bring about temporary relief of symptoms but recurrence, necessitating frequent treatment, is common.

Vaginal incision with drainage has been advocated in the past for urethral diverticula. This procedure was carried out initially in our group but was abandoned as unsatisfactory. It did not result in a urethrovaginal fistula as one might expect, but the recurrence rate was extremely high.

It is now our practice to excise all urethral diverticula which are causing symptoms, regardless of their size or degree of infection if the patient's physical condition permits. This is done under spinal anesthesia either in Kraske's or exaggerated lithotomy position. With a Foley catheter in the urethra, the anterior vaginal wall is opened exposing the sac. It is then isolated, opened, and excised in the same manner as a hernial sac. The urethral defect is closed with multiple fine catgut sutures imbricating the urethra over the catheter. The pubovesical fascia is approximated with interrupted sutures. The vaginal mucosa is closed separately after first excising any redundant tissue. Care should be exercised to avoid undue sacrifice of mucosa. Catgut sutures are used throughout, and healing usually occurs promptly.

The Foley catheter is left in the bladder for 5 to 10 days or until healing is complete. The administration of antibiotics preoperatively has been found to add nothing to the end results, though it is customary to use urinary antiseptics after operation while the catheter is in place.

One patient had an extremely large communication between the urethra and the diverticulum. It was believed that excision might result in a postoperative urethrovaginal fistula, and, therefore, the diverticulum was obliterated by multiple sutures in the process of anterior vaginal wall repair. Almost two years have elapsed since operation, and the patient remains asymptomatic.

In general an operation is performed only when a diverticulum is palpable along the urethra. If the presence of one is suspected but cannot be established

by examination, the patient should be seen again at a later date. Since the urethral glands tend to girdle the urethra, diverticula may be located lateral to the urethra rather than beneath it. Here they are difficult to palpate and are often missed. One is occasionally justified in exploring the urethra transvaginally when a diverticulum is suspected but cannot be palpated. This was done for one patient who was found to have a large, infected, saddle-type diverticulum.

Complications

Of 45 patients, 8 had asymptomatic diverticula, 4 had physical contraindications to operation, and 33 have been operated upon. Twenty-eight were entirely relieved of symptoms and had no complications following excision of the diverticula.

Two patients developed postoperative urethrovaginal fistulas: one had a stone in the diverticulum measuring 3.9 by 2.8 by 2.5 cm.; the other had four small stones. The first patient was operated upon successfully a second time, but the second patient apparently still has a fistula. Her symptoms are not severe enough for her to want operative repair. A third patient who had an "olive-sized" stone was operated upon without complications.

Reoperation was necessary in 2 patients who had persistence or recurrence of symptoms, resulting from multiple diverticula that were incompletely removed at the first operations. The second operations resulted in relief of symptoms, and no complications occurred. Our experience with these 2 patients demonstrates the need for careful preoperative evaluation and perhaps exploration of the entire urethra at the time of operation.

One patient developed mild urinary incontinence probably as a result of destruction of muscle tissue surrounding the urethra secondary to exploration. With directed exercises her urethral function has since returned to normal.

Summary

Forty-five cases of diverticulum of the urethra have been reviewed. Twelve of these have been reported previously.

The main symptoms are dysuria, frequency, and nocturia. In addition, many patients noticed a painful mass in the anterior vaginal wall associated with dyspareunia and/or dribbling of urine after voiding. Some diverticula are asymptomatic.

The diagnosis of urethral diverticulum is best made by palpation of a mass along the anterior vaginal wall. Pressure on the mass often causes the contents of the sac to exude from the urethral meatus. Urethroscopic examination and roentgenographic study of the urethra are useful in confirming the diagnosis and in evaluating the size and type of diverticulum. Some are composed of a single sac, but others are multiloculated, often extending up around the urethra.

Excision is the treatment of choice for all symptomatic diverticula. Thirty-three patients have been operated upon for this condition. Two patients with stones in the sac developed postoperative urethrovaginal fistula; one was repaired successfully, and the other was not bothersome to the patient. Two others required reoperation for relief of symptoms due to incomplete excision.

Careful palpation and inspection of the urethra for urethral diverticulum should be part of every cystoscopic or vaginal examination.

Addendum.—Since this paper was written, 4 more patients with urethral diverticula have undergone surgical correction, bringing the total number of cases we have seen to 49.

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Department of Case Reports
New Instruments, Etc.

LOCATION OF A METALLIC FOREIGN BODY IN THE ABDOMINAL CAVITY

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THE presence of metallic foreign bodies in the abdominal cavity is uncommon. As a rule the following etiological factors obtain: (1) previous surgical procedures during which instruments or needles have been inadvertently left in the abdominal cavity; (2) penetrating abdominal wounds resulting from firearms, i.e., bullets, shrapnel fragments; (3) self-insertion of a foreign body, i.e., metallic knitting needles used for attempted abortion, forced through the uterus, broad ligament, or cul-de-sac (this history is often withheld by the patient); (4) accidental ingestion of a metallic foreign body, often with resulting perforation of the bowel wall and entrance into the abdominal cavity, e.g., swallowing of pins by millinery workers. This may be the cause of otherwise unexplainable recurrent episodes of peritonitis. Migration to the abdomen along tissue planes from a remote focus of entry appears unlikely.

Fig. 1.—Unsuspected straight needle in the left lower quadrant, revealed by flat plate of the abdomen and pelvis.

Our interest in metallic bodies in the abdomen was aroused by the admission of Mrs. C. S., (No. 361946), aged 42, to the Brooklyn Jewish Hospital on April 24, 1953, because of vaginal

bleeding. Her menses, which began at the age of 12 years, occurred at irregular intervals and lasted for 6 to 8 days. The first episode of hypermenorrhea occurred in February, 1952. The succeeding March period began on the sixteenth and continued until admission 5 weeks later. The general physical examination was not remarkable except for secondary anemia.

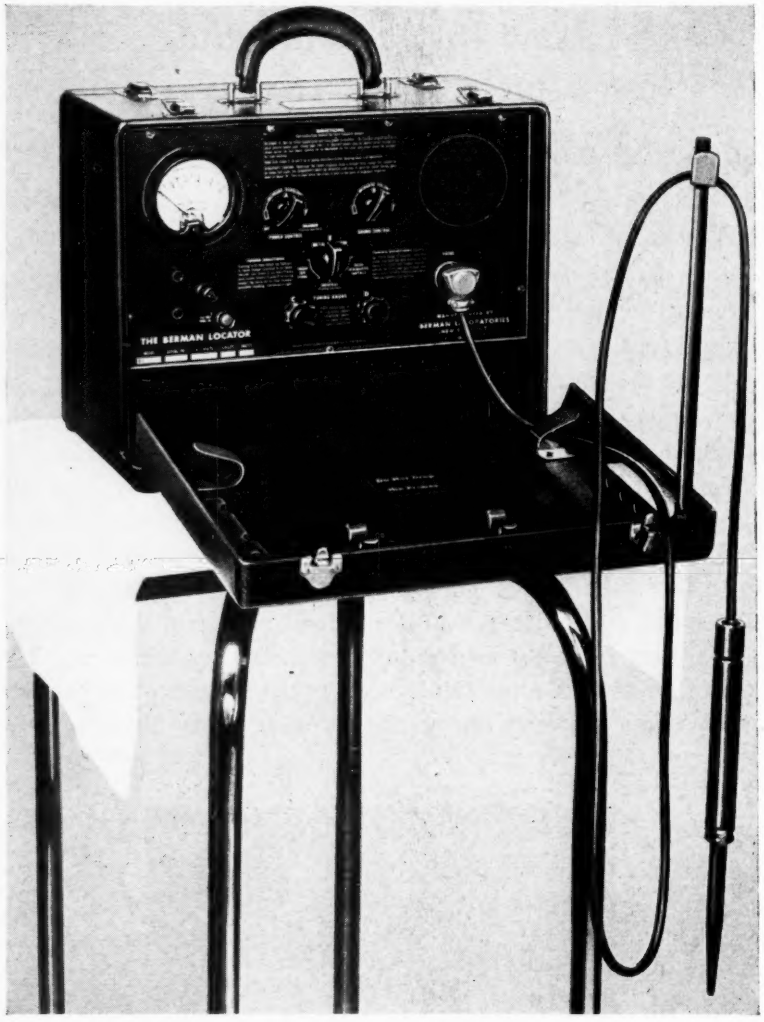

Fig. 2.—The locator showing the metallic probe attached to the meter. A loud-speaker in the case produces a hum when the probe approaches the metallic body.

Pelvic examination revealed normal external genitals. The introitus was nulliparous. The cervix revealed no abnormalities. The uterine body was irregular, nodular, and the size of a ten weeks' pregnancy. The adnexa were normal. A diagnosis of fibromyomas of the uterus was made. The serologic test was positive and by the VDRL technique revealed a titer of 1:8. An x-ray survey, because of vague abdominal pains unusual in a case of fibroids, revealed the presence of a needle in the lower left side of the abdomen (Fig. 1) but its exact anatomical site could not be determined. Laparotomy on May 12, 1952, confirmed the diagnosis of fibroids and a total hysterectomy and bilateral salpingo-oophorectomy were performed. The needle revealed by x-ray, however, was neither visible nor palpable. By the use of an electromagnetic locator* (Fig. 2), it was traced to the free border of the omentum, at its

*Made by Berman Laboratories, 534 West 42nd St., New York, N. Y.

left anterior aspect. Resection of this segment revealed a partially corroded straight needle lying within the fatty areolar tissue (Fig. 3). The postoperative course was uncomplicated. Pathological examination of the specimen revealed the coincidence of corporeal carcinoma with the fibromyomas. The patient was accordingly referred for postoperative radiation of the abdomen and pelvis. To date, the patient is symptom free and there is no evidence of recurrent malignancy.

Varied techniques to aid in the location of foreign bodies in tissues have been evolved. Thus x-ray of the affected part using the principle of parallax and similar triangles is employed by E. W. H. Shenton.[1] Fluoroscopic localization based on triangulation is proposed by H. W. Jamison.[2] Localization by use of a metal clip placed in the wound under direct vision and study of the foreign body in relation to it, in anteroposterior and lateral roentgenograms, has been recommended by Brech and Maylahm.[3]

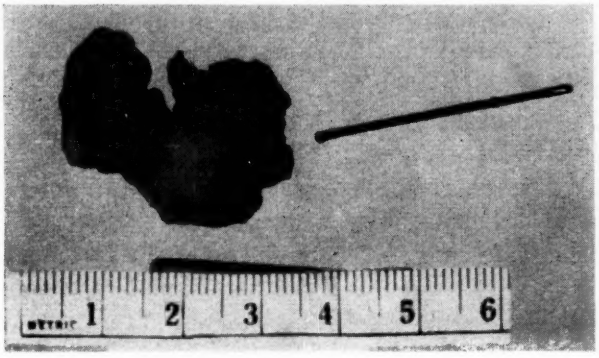

Fig. 3.—The segment of excised omentum in which the partially eroded needle was loosely rolled.

The metal locator used in this case operates on the principle of electromagnetic induction, employing a thin pointed probe for detection of the foreign body. Localization is based on the indications of a meter and a small loud-speaker operating simultaneously from the panel of the electronic amplifier to which the probe is attached. The locator detects and localizes metallic foreign bodies through the action of alternating magnetic fields within the probe that cause electrical impulses whenever a metallic object enters within the effective fields of the probe. These impulses are amplified by the instrument circuits, and cause the meter to register, and simultaneously a sound issues from the loud-speaker to rise in pitch as the probe approaches the metallic foreign body. As the probe is moved about the suspected area, the operator listens to the changing pitch, or observes the indications on the meter, and moves the probe in the direction giving the maximum indication. The point giving the peak indication is the closest approach to the foreign body. Intervening bone, tissue, or fluid does not interfere with detection or localization.

Summary

1. A flat plate of the abdomen, in a patient with fibromyomas associated with carcinoma of the uterine body, revealed the presence of an unsuspected needle in the lower left side of the abdomen. Bizarre abdominal complaints led to the use of the roentgenogram.

2. The history was noncontributory as to the mode of entrance of the needle into the abdominal cavity.

3. Inspection and palpation of the abdominal contents during the course of complete hysterectomy and bilateral salpingo-oophorectomy failed to locate the foreign body.

4. Use of a locator depending on the principle of electromagnetic induction localized the needle in the left lower margin of the omentum.

5. The resected omental segment contained a corroded sewing needle.

6. The electronic principle underlying the use of the locator is briefly discussed.

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POSTMORTEM CESAREAN SECTION

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(From the South Nassau Communities Hospital)

IN A recent paper by Lattuada,[1] a compilation of "successful" cases of postmortem cesarean section revealed only 22 until the year 1950. The addition of 2 more by Lattuada himself brought the total number to 24, only 12 of them reported from this country. This fortunately rare condition requires the coincidence of so many varying factors, that it falls to few individuals to encounter it.

The use of the term "successful" is obviously a qualified one. The 2 cases reported by Lattuada, for example, resulted in infants that lived for eight hours and thirty-six hours, respectively. The primary factors influencing the "successful" outcome of any given case include the type and rapidity of the maternal death, the degree of toxicity produced by the terminal illness, the fetal age, the length of intrauterine life after maternal death, and the neonatal care of the delivered child.

Walker and Matthews[2] added 2 additional cases resulting in live infants. Both patients were being prepared for cesarean section after labor had progressed in the presence of contracted pelves. Maternal death resulted in both cases from spinal anesthesia, and the presence of the surgeon and a prepared operating room favored the successful fetal outcome.

The recent report by Weil and associates,[3] in 1953, added another case with a completely successful fetal outcome. The child was discharged from the hospital on the fortieth day in good condition. The maternal death from a dissecting aortic aneurysm had occurred in the eighth month of pregnancy and while the patient was hospitalized.

The addition of the case of Baden and Baden[4] will undoubtedly cause some statistical confusion. Their patient, after a trial of labor with no progress, was being prepared for surgery. After the spinal anesthesia was administered successfully, and a low cervical cesarean section started, a complete cardiac arrest intervened and the immediate delivery of a living infant was accomplished. After a total cardiac arrest of approximately eight to ten minutes, the beat was re-established and the mother lived for three more days. While the legal definition of "death" was not satisfied at the time of delivery, this case may be construed as one of the number. The child was well at 3 months of age.

Of the 4 cases added since the compilation of Lattuada, all infants lived to be discharged from the hospital. The factors in their favor were (1) the hospitalization of all four cases, (2) the fact that three of the patients were

being prepared for, or were actually undergoing section at the time of the maternal death, and (3) that there was no toxicity in any of the mothers at the time of death.

We would like to add a further case of only limited "success" to the literature. The circumstances surrounding the entire picture were bizarre enough to warrant some interest.

Mrs. D. S., 40 years of age, was first seen on Sept. 10, 1951, after a five-month period of amenorrhea. The patient was a Christian Scientist and had never taken any medication except dietary additions in the form of vitamins and minerals. Her previous medical history included an episode in 1947 that had been considered a cerebrovascular accident, but no special examinations were made, and the patient fully recovered from the transient illness. At about this time she had also aborted after a three-month amenorrhea, but again no medical treatment had been necessary. About three years before, her brother had died from cancer of the throat, and since that time the patient had become depressed, aphonic, and anorexic. She lost weight rapidly but continued her daily housework. For the three years preceding this pregnancy she had had no medical attention, but presented no new symptoms other than a chronic cachectic appearance.

The last menstrual period had started on April 11, 1951, after several years of completely normal cycles. The date of expected confinement was Jan. 18, 1952, and physical examination in September confirmed the presence of a pregnant uterus of about five months' size. Her general condition was poor; a woman of 5 feet, 7 inches, who weighed only 113 pounds, with a hemoglobin of 60 per cent, and a beefy red tongue. There was no evidence of neurological or neoplastic disease in any of the examined areas. Her blood type was A and she was Rh positive; serologic examination was negative. The pelvis was clinically ample. A request for a more complete evaluation by an internist was never actually refused, but always put aside for "the near future."

Because of the difficulty of the situation, an elderly primipara with her first viable pregnancy, her emaciated, anemic state, and her poor mental outlook, she was seen twice a week for one month and then once a week. During that period of time, her weight had risen from 113 to 117 pounds and then dropped to 112 pounds. Blood studies showed a normal white cell count and differential, and a hypochromic anemia that showed little improvement with as much parenteral liver extract, vitamin B complex, and iron as could be conceivably administered to a patient who remained wary of all medication. A period of hospitalization for more complete study and a consultation with an internist were advised, but both were declined by the patient. This was the state of affairs when the patient was seen in the office for the last time on Nov. 12, 1951. On that day, she was sent to the laboratory for another blood count, given an injection of liver extract and iron, and encouraged to see an old family friend, a capable internist.

Three nights later, a phone call from the husband stated that his wife had been in bed for the previous three days but now was quite hot and had difficulty breathing. On examination, the temperature was 104° F. by rectum, the pulse 124 per minute, and the respiratory rate 34 per minute. The entire right side of the chest was completely consolidated and the patient appeared moribund. Realizing the seriousness of the situation the husband agreed to hospitalization, and the patient was immediately sent to South Nassau Communities Hospital. Intensive penicillin and Aureomycin therapy and continuous oxygen were started. Her admission during the night made any pertinent laboratory work difficult, and her condition by morning had so deteriorated that even transportation by bed to the x-ray department was futile. During the twelve-hour hospital stay, she gradually became comatose and was pronounced dead at 11:10 A.M. on Nov. 16, 1951.

Anticipating maternal death in the last hours, and in the presence of a seven months' gestation, arrangements were made to perform a postmortem cesarean section in order to deliver a living child if possible. When the patient was pronounced dead by two physicians, a rapid classical cesarean section was done with the delivery of a 4 pound, 5 ounce female

child from left occipitoanterior position. The child gasped and breathed immediately, and was directly transferred to the Obstetrical Floor. In spite of aspiration, oxygen, and stimulants, she died at 11:30 A.M., after living for twenty minutes.

Summary

The twenty-eighth or twenty-ninth case of "successful" postmortem cesarean section is presented. The death of the infant after twenty minutes of neonatal life was attributed to prematurity and "toxicity." The death of the mother resulted from an overwhelming pulmonary infection in the right upper, middle, and lower lobes. Three days of progressive infection and toxemia because of reluctance to use accepted antibiotic therapy made an unfavorable termination in both mother and child almost inevitable.

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A CASE OF KNOTTED CORDS IN A MONOAMNIOTIC TWIN PREGNANCY

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THE incidence of monoamniotic twinning is stated to be 1:6,000 deliveries by Muller and 1:60,000 deliveries by Rosenberg (as quoted by Boyle and Richter[1]). However, a recent report shows that during an 18 month period in New Orleans five cases of this condition were noted.[2] Thus it is possible that this type of twinning occurs more frequently than is supposed.

Quigley,[3] in his comprehensive review in 1935, was able to collect 109 cases of monoamniotic twins. He stated that in 53.2 per cent of these cases the cords were either involved in knots or in severe torsion. The corrected fetal and neonatal mortality for this series of cases was 68 per cent. King and his associates[2] were able to collect 34 additional cases since Quigley's report and added 5 of their own, thus giving a total of 148 cases.

There are two theories prevalent concerning the cause of monoamniotic twinning[3]: The theory of primitive duality states that originally there are two amnions, and that the two cords lying together on either side of the partition cause it to rupture as a result of their pulsations; the other theory is that of primitive unity, and maintains that during embyonic development the two blastodermic vesicles meet and join and are enveloped by one amnion.

Browne[4] quotes Baudeloque as maintaining that the cord could never be knotted tightly enough before labor to cause death. He[4] also quoted Chantreuil as believing that true knots could cause intrauterine death, and that even if the child were born alive, he might be malnourished. Browne was able to prove experimentally that even small weights and pressures applied to a loosely knotted cord could tighten it sufficiently to interfere seriously with the circulation in its vessels. McNally[5] called attention to the fallacy of a prevalent belief that fetal death from a true knot of the cord could occur only during labor.

All cases of monoamniotic twins with or without knotting of the cords should be reported so that a more accurate estimate of the frequency of this condition may be obtained. It is with this in mind that the following case of monoamniotic twins with knotted cords is submitted.

Case Report

Mrs. J. S., 25 years old, para i, had her last menses on Jan. 7, 1952. She was first seen April 18, 1952, and was checked at regular intervals through Sept. 22, 1952. Physical examination was negative except for findings concerned with a normal intrauterine pregnancy. At no time during the prenatal course was her blood pressure or urine abnormal, and there were never any toxic symptoms. On June 16, 1952, since the patient's abdomen was obviously much larger than it should have been for the period of gestation, an x-ray was taken which showed the presence of twins. Her expected date of confinement was calculated as being Oct. 14, 1952. Her last visit to the office was on Sept. 22, 1952, at which time she stated that she had not noted as much movement the last 24 hours as usual. No fetal heartbeat was heard. Around noon on September 30, the patient experienced some cramps and

noticed a small amount of dark-colored watery fluid coming from the vagina. She entered the hospital at about 4 P.M. the same day, and was moved immediately to the delivery room, since the cervix was completely dilated and the head of the first baby was bulging the perineum. The first baby was then delivered spontaneously. He was stillborn and moderately macerated. The brain was in an advanced state of autolysis, causing the head to have a "mushy" feel. The cord was clamped and cut in the hope that the second baby would be alive. However, before the birth canal could be explored, one foot of the second baby and a complexly knotted portion of cord prolapsed out of the vulva. The baby's foot was macerated so that it was obvious the second baby would also be stillborn.

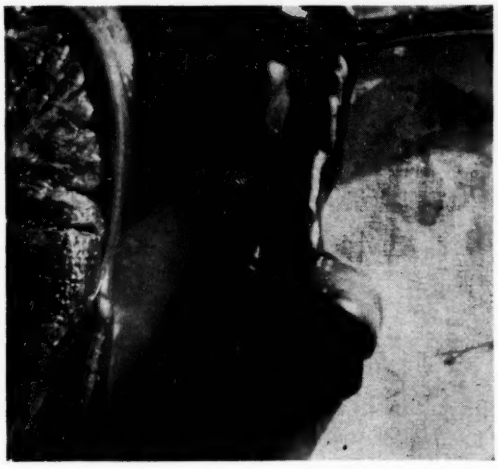

Fig. 1.

After the delivery of the first baby there was no sign of rupture of a second bag of waters. The second baby was then easily delivered by partial breech extraction and the rest of his body was also somewhat macerated. The cords of both babies were involved in a tightly pulled knot of "double granny" type. The cords were attached near the center of the single placenta, and their insertions were about 2 inches apart. The cords were of average length and the knots were about equidistant between the placental and umbilical extremities. There was no evidence of any partition between the two cords. The placenta was otherwise not remarkable, had separated spontaneously, and was easily expressed. The patient's postpartum course was uneventful and she was found to be quite normal at her checkup visit on Nov. 10, 1952.

Conclusions

The exact incidence of monoamniotic twinning is not known at present. The condition frequently is complicated by knotting of the cords with a resultant high fetal mortality. The two theories of the cause of monoamniotic twins are reviewed, and a case of monoamniotic twins with knotting of the cords producing double stillbirth is presented.

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LYMPHANGIOMAS OF THE GENITAL TRACT

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ALTHOUGH Steinharter[11] in 1913 was the first to apply the term mesothelioma, it was not until 1942 when Masson, Riopelle, and Simard,[9] and Evans,[2] in 1943, independently reapplied the term to a distinct group of small tumors of the male and female genital tracts. Since that time there has been considerable interest in these neoplasms; numerous cases and series have been reported and much has been written regarding their histogenesis. Many authors have reviewed the literature and cited the multiplicity of terms applied to these lesions. It is not my purpose to summarize the cases reported nor the terminology applied, but merely to offer a small piece of evidence which tends to indicate that these neoplasms are lymphangiomas and hence to simplify the already superfluous nomenclature.

The basic theories of histogenesis of these small asymptomatic tumors classify them as mesothelial, epithelial, or endothelial in origin. Evans[1] believed they were of mesothelial origin and was able to demonstrate continuity between the serosal mesothelium and the lining cells of the channellike spaces composing the tumor. Other workers (Lee and associates,[8] Fajers,[4] and Horn and Lewis[6]) in reporting their series of cases have concurred in this theory of histogenesis and have also commented on the usual proximity of these tumors to the serosal surface of the organ involved. Golden and Ash[5] in 1945 presented an excellent cytologic study of a relatively large series of these tumors and concluded that an epithelial origin could not be denied and, since the genesis was obscure, they proposed the name adenomatoid tumors. More recently some authorities (Novak[10]) have returned to the original term lymphangioma first applied by Kermauner[7] in 1907. It is interesting to note that Ewing[3] commented on a peculiar lymphangioma of the spermatic cord he had seen.

Our material consists only of a single tumor characteristically encountered as an incidental finding at the time of surgery in a 36-year-old white woman. The tumor was located in the middle third of the oviduct, measured 1.5 cm. in diameter, was extremely firm, spherical in outline, and appeared to be sharply demarcated. It encompassed the full circumference of the duct (Fig. 1). Since we were searching for such suspicious lesions, the entire tumor was embedded in paraffin and once the diagnosis was confirmed serial sections were made. Review of these sections revealed three interesting observations:

1. For the most part the tumor appeared intrinsic to the duct, being surrounded on all aspects by bundles of smooth-muscle cells composing the wall of the oviduct (Fig. 1). This "capsule" was thinnest about the periphery.

2. At only one point did the tumor reach the serosa and here only a few channels were continuous with the peritoneal mesothelium. No invagination of the serosal mesothelium was apparent and the tumor appeared to approach rapidly (Fig. 2) and then erupt through the serosal surface.

Fig. 1.

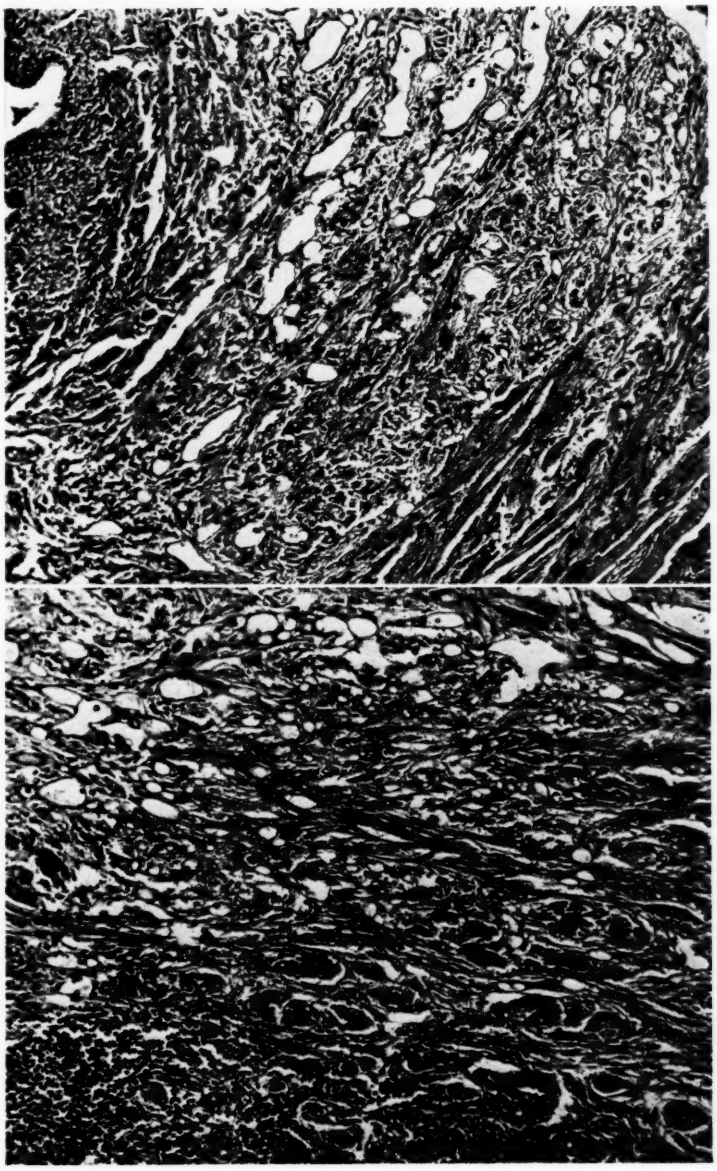

Fig. 2.

Fig. 1.—Photomicrograph of lymphangioma. The tubal lumen is in the upper left and the peripheral musculature surrounding the tumor in the lower right.

Fig. 2.—Photomicrograph of lymphangioma. A subserosal cluster of lymphocytes is along the bottom and to the left; the tumor is approaching the serosal surface of the duct.

3. At each pole and along the periphery of the tumor were numerous collections of lymphocytes (Fig. 2), frequently commented on by the older authors who believed the tumors were lymphangiomas since these clusters are characteristically found in those neoplasms.[3] However, no true lymphatic channels were observed in the distal sections.

From these findings we conclude that the much-emphasized serosal continuity of the tumor is merely a coincidental manifestation of tumor growth rather than a true focus of origin. It is felt that these tumors are true neoplasms of the delicate lymphatics lying beneath the serosa of the genital tract.

Summary

1. The three basic concepts of the histogenesis of a small group of genital-tract tumors are reviewed.

2. Evidence is presented that these neoplasms are lymphangiomas. This conclusion is based on complete serial section of a single small tumor from the oviduct.

3. It is hoped this histogenic theory can be corroborated and elaborated upon by other workers using a similar method of study.

I wish to express my appreciation to Dr. John C. Henthorne who suggested this problem.

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DYSTOCIA CAUSED BY FECAL IMPACTION

Case Report

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THIS case is reported because it is unique in our experience and because it stresses the importance of prenatal care.

Case History

E. O., Case No. 23359, a 24-year-old white woman, gravida ii, para i, with an estimated date of confinement of Aug. 17, 1953, was admitted to the labor floor on July 24, 1953, with a history of premature onset of labor associated with profuse vaginal bleeding and abdominal pain. She said that she had neglected prenatal care because she had a fear of physicians. The pregnancy had been uneventful, with only moderate nausea and vomiting, no history of bleeding, and an active fetus. Three days before the day of admission she said that she had had pains in the back. The membranes ruptured on the same day and she continued to lose amniotic fluid until the day of admission. On the day of admission the pain increased in severity and toward evening she began to bleed profusely, for which she was brought to the hospital.

She was a short, medium-sized, pale, apprehensive young woman who thrashed around in bed resisting all attempts to examine or help her. The pulse was 140, thin and thready. The blood pressure could not be taken because the patient resisted.

When all attempts to obtain cooperation from the patient had failed, compulsory methods were utilized. Rectal examination revealed a large fecal mass filling the entire pelvis, no presenting part or cervix being palpable. The abdominal contour was irregular with a pathologic retraction ring 2 cm. below the umbilicus. The fundus was 6 cm. below the xiphoid and no fetal heart sounds were heard.

Upon the completion of the rectal examination the patient began to pass spontaneously a large stool approximately 7 to 8 cm. in diameter. Under Trilene analgesia, 2¼ pounds of feces were evacuated digitally from the rectum. There was a moderate amount of vaginal bleeding during this procedure. The patient was prepared, catheterized, and transported to the delivery table for a sterile vaginal examination. It was felt that a rupture of the uterus was imminent and that a cesarean section was probably indicated.

Soon after the patient was placed in the lithotomy position the presenting part descended to the perineum and was found to be a frank breech in right sacroanterior position. An assisted breech delivery was accomplished under nitrous oxide and oxygen. The baby was a stillborn female that weighed 5 pounds, 6 ounces. The placenta was spontaneously expressed. Inspection of the placenta revealed a marginal separation of approximately one-fourth of the placental surface.

Palpation of the patient's abdomen following delivery showed the presence of two distinct and separate masses. On the right side one could feel the contracted uterus while on the left side there was a mass apparently filling the descending colon and left half of the transverse colon. The colon was distended 8 to 9 cm. in diameter and the mass could be impressed with the thumb, and resembled feces in texture.

The patient was returned to her room in good condition after a transfusion of 500 c.c. of whole blood and 1,000 c.c. of 5 per cent glucose in water.

The following morning the patient admitted that she had gone at least one month without a bowel movement. The colonic fecal mass was treated with oral mineral oil, high enemas of mineral oil and soapsuds, and a low-residue diet. Initial results were poor but on the fifth postpartum day she had a tremendous evacuation in which the entire abdominal collection was expelled. The uterus returned from the right colonic gutter to the midline and dropped back into the pelvis. The patient was discharged in a satisfactory condition on the seventh postpartum day.

It is our opinion that this case presents an example of a pathologic retraction ring due to fecal impaction which obstructed the engagement and descent of the fetus. The removal of the mass allowed a spontaneous delivery. Associated with this obstruction was a premature separation of the placenta which together with prolonged obstructed labor resulted in a stillbirth. The death of the fetus was directly attributable to the lack of prenatal care and this death should have been prevented.

SIGMOID-AMNIOTIC FISTULA COMPLICATING AN EXTRAUTERINE PREGNANCY

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CAPTAIN G. C. DAUGHTRIDGE, MEDICAL CORPS, UNITED STATES NAVY, AND
COMMANDER H. HUNTER, MEDICAL CORPS, UNITED STATES NAVY*

(From the United States Naval Hospital, Portsmouth, Va.)

SIGMOID-AMNIOTIC fistula is a rare and perhaps previously unknown complication of extrauterine pregnancy. A careful search of the literature did not reveal a similar case report.

Case Report

T. K., a 29-year-old Negro woman, gravida i, para 0, was first seen in August, 1951, because of "toxemia of pregnancy." Her estimated date of delivery was in September, 1951. The last menstrual period was in December, 1950. Her previous menstrual history was not remarkable. She recovered from the edema and was discharged from the hospital without going into labor.

She was admitted again in December, 1951, at which time the abdomen was found to be half as large as on the previous admission. She stated that she last felt life soon after the previous admission.

The physical examination showed her to be in no distress. An abdominal mass was palpated which extended to the umbilicus. There was no evidence of fetal heart sounds or fetal movements. The pelvic examination showed a short, soft, clean, nulliparous cervix. No mass was palpable separate from the uterus. An induction was attempted with Pitocin without result.

Roentgenograms showed a single fetus of approximately six months' gestation in a breech presentation, left sacroposterior. There was overriding of bones indicating fetal death. A thick wall of soft-tissue density was seen around the fetal parts.

After a few days in the hospital the patient developed a fever which could not be controlled by antibiotics or any other therapy.

X-rays showed no change in the size of the fetus. The collapse of fetal parts was more marked. The spine was now cephalad and small parts caudad. Large amounts of gas were present in and around the fetus (Fig. 1).

At this time the cervix was sounded to 3½ inches and solid resistance was encountered. She was therefore examined and a diagnosis of extrauterine pregnancy with gas bacillus infection made.

At laparotomy a small corpus uteri was found which was displaced anteriorly by a thick-walled sac containing a fetus. This arose from the left cornu and was encapsulated by the left infundibular ligament. The left ovary was palpated in the gestation sac, and the omentum was adherent to the dome of the sac. The sigmoid was found to be densely adherent to the posterior inferior wall with an opening 2 by 4 cm. in diameter between the lumen of the sigmoid and the cavity of the gestation sac. The opening was closed and a total hysterectomy was performed with removal of this sac. A sigmoid colostomy was made. The postoperative course was relatively uneventful and the colostomy was later closed.

*The opinions expressed are those of the authors and not necessarily of the Navy Department.

The pathological examination revealed (1) an ectopic tubal pregnancy (left), (2) a macerated fetus, (3) perforation of the left Fallopian tube, (4) necrosis of the placenta, (5) acute and chronic inflammation of both Fallopian tubes.

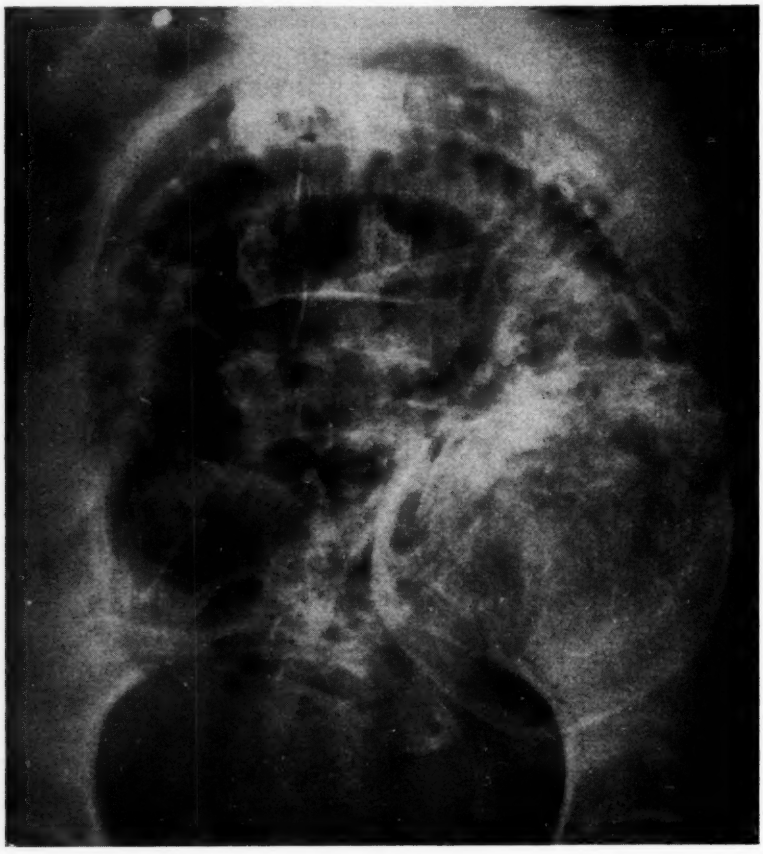

Fig. 1.

Comment

Usually a tubal pregnancy will rupture at six to eight weeks' gestation and cause an acute surgical emergency because of intra-abdominal bleeding. Occasionally, it will terminate with passage of the fetus or placenta per vaginam or into the peritoneal cavity. Rarely, the placenta retains its primary attachment to the Fallopian tube with the fetus in the peritoneal cavity. The fetus may then continue to grow. Occasionally this continues to term, but usually the fetus dies as a result of later placental separation. If not surgically removed, this fetus will calcify and become a lithopedion. An extremely unusual termination of intra-abdominal pregnancy by a sigmoid-amniotic fistula is illustrated in the case reported.

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Editorial

The Special Issue of the Obstetrical and Gynecological Survey on the Seventieth Birthday of Emil Novak

In the year in which we ourselves have been honoring our own great Editor, we are happy to recognize a similar event occurring in the *Obstetrical and Gynecological Survey*. Dr. Emil Novak had his seventieth birthday on March 8, 1954, and the February number of the *Survey* was a special one in his honor.

The February number of the *Survey* was a fitting tribute and a source of information about Dr. Novak himself, containing brief biographies from several points of view and a collection of letters of congratulations from colleagues throughout the world.

In this Special Number there was also republished a series of editorial comments written by Dr. Novak to follow abstracts published in the *Survey*. They illustrate his acute grasp of the essentials in any new contribution and seem to show how his keen but kindly criticism has helped to maintain the integrity and scientific standards of writing on gynecological topics.

Finally, a selection of certain of Dr. Novak's own contributions has been republished. These emphasize the enormous influence that Dr. Novak's work has had on the modern knowledge of such topics as the anatomy of the corpus luteum, hyperplasia of the endometrium, the histology of the menstruating endometrium, and the classification of ovarian tumors. Dr. Novak's fine philosophy of medical education and practice is summed up in his Presidential Address given before the American Gynecological Society in May, 1948. His contributions to the scientific literature appear in his complete bibliography, to all ordinary mortals discouraging in its length and excellence.

We congratulate the Editors and Publishers of the *Survey*—and Dr. Novak.

The Editors

The Editors and Publishers regret to announce that as the JOURNAL goes to press word has been received of the death of Dr. George W. Kosmak on July 10. An obituary will be published in a later issue.

Correspondence

Genetic Dangers Inherent in Ovarian Radiation

To the Editors:

There are two statements which are frequently made by those obstetricians who use x-radiations to the ovary to overcome sterility. They are: "X-rays do overcome sterility in some resistant cases and anything we can do to help a woman have her baby is justified," or, "While mutations may be produced by x-rays in the fruit fly, Drosophila, similarly produced mutations have not been demonstrated in the human being."

This is sometimes further amplified by: "Even if mutations are produced by x-rays to the ovary, they are largely recessive and might never show up in the offspring. What might happen within the next 200 years if I x-radiate an ovary now is of no concern to me."

These are essentially the two major themes in the article by Dr. Ira I. Kaplan which recently appeared in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY (March, 1954, page 484.) From the point of view of the radiobiologist with 24 years of research experience in experimental embryology, I should like to discuss each of these contentions.

There is indeed evidence that direct x-radiation of the human ovary by 50 r at three sessions may be followed by fertility. Kaplan reports favorable results in some 35 per cent of the selected cases. A single exposure of 200 r (tissue dose) x-rays will cause temporary and 400 r (T.D.) permanent sterility in an otherwise normal human ovary. Before conceding that x-radiation is the causative factor in overcoming sterility, it would be necessary to run some controls with phantom radiations to exclude the psychological factors.

Research experience with mice and rats indicates that low exposures to the ovary or testes will reduce fertility by causing fetal resorption. Of course, Dr. Kaplan can never know how many times this occurs among his x-radiated patients since his criteria are only those offspring which come to term. He states that these are all normal in infancy, both mentally and physically, as determined by a pediatrician. If this is so, he is most fortunate. One should remember that in the state of New York alone there are some 200,000 mental defectives, most of whom would have been pronounced mentally and physically "normal" in childhood.

One realizes that x-radiation of the pituitary gland does not involve any genetic risks and many clinical radiologists have limited their antisterility treatment to this gland alone. Nevertheless, with regard to x-radiation of the pituitary gland on the supposition that, as a source of the follicle-stimulating hormone, it could be stimulated to action, one must point out that there has been no substantiated research which proves that x-rays have such a stimulating effect. The only possible exception might be leukemia which may occur many years after whole body x-radiation. In experimental studies the pituitary gland may be subjected to 50,000 r without altering its potency with respect to its gonad-stimulating properties. It is therefore difficult to see how 80 r to the pituitary could have more than a psychological effect. It is fortunate in this period of experimentation that the eye of the human being is more resistant than is the eye of the mouse with respect to cataract formation following x-radiation. In the hands of careful radiologists cataracts do not normally follow pituitary x-radiation, although such radiologists are aware of the possibility from scattered radiations. Until recently the central nervous system was presumed to be highly radioresistant, but now the neuroblast is believed to be as sensitive as is the lymphoblast.

In answer to the first statement, therefore, we can say that x-radiation of either or both the ovary and the pituitary may seem to overcome sterility in about one-third of the selected cases, but it is definitely not proved that there is a causal relationship. I am not aware of any Sterility Clinic which uses radiations to the ovary to bring on fertility.

The second statement previously quoted refers to x-radiation of the ovary alone and to genetic or hereditary considerations. To those trained in genetics the argument against the use of x-rays is most persuasive. No experienced geneticist would allow his wife to be treated for sterility with x-rays to the ovaries. It is impractical to review the major foundational concepts of genetics, so that this second quotation will be answered with several statements, all of which can be supported with research findings:

1. Muller first showed in 1927 that x-rays are the most potent device for bringing about hereditary changes through x-radiation of the gonads. This has proved to be true for all animals studied, including mammals.[1]

2. When an ovary is x-radiated, every egg, whether mature or immature, is subjected to radiation-induced changes. The effects of radiations on the reproductive cells (ova or spermatozoa) are cumulative, and the degree of effect is a function of the dose.

3. A single ionization may bring about a mutation. Once induced the mutation will last as long as progeny exist. The change is permanent.

4. A dose of 80 r to the ovary or testes will double the natural rate of mutation production in lower forms. In the immature human germ cell where there are 48 chromosomes the chance of ion hits on genes to produce mutations is greatly increased.

5. If x-rays to the ovary or testes do not cause fetal death, they will not likely produce any abnormalities in the first generation offspring. Most of the surviving mutations are deleterious recessives. Snell[2] has shown that when male mice are x-rayed and paired with normal females they produce *only normal offspring.* If this first generation is then mated with normal mice some 38 per cent of their offspring develop a major teratologic abnormality of herniated brains.

6. A single recessive mutation, produced in a single ovary by as little as 1 r would, in 21 generations of four children each, have become lodged in the ovaries and testes of over 1,000,000 people. This would occur without any intermarriage. The radiation of an ovary may have a widespread effect on the future of civilization.

There is a major misconception among genetically untrained scientists, namely, that *what one cannot see* in a physical examination can have no consequence either for the individual or for the race. A corollary of this misconception is that *what teratologic abnormalities do not appear* in the first generation following x-radiation of the gonads will never appear. These are errors for which history will no doubt call some people to account. The so-called "normal" individuals have no controls for comparison. Many of them may prove to be sociological problems far more serious than had the mutations included a dominant lethal which killed in utero. The connecting link between generations is the germ cells and when the obstetrician exposes these to x-rays he is tampering with an entire hereditary line, which will exist as long as there are progeny. To add to its inherited store of mutations is a responsibility that no geneticist would assume.

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NEW YORK, N. Y.
MARCH 11, 1954

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2. Snell, G. D.: Radiology **36**: 189, 1941.

Comparison of Fetal Mortality Rates

To the Editors:

I read with interest the article prepared by Drs. Erving and Kenwick on internal podalic version (AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, vol. 67, p. 315, February, 1954). Although, I would find it difficult to follow their example, they have certainly reviewed a worth-while group of cases. However, I must clarify certain remarks made, particularly in reference to the article on midforceps (AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY, vol. 65, p. 294, February, 1953) by Drs. Dickson, Heaton, and myself.

They have compared a fetal mortality of 2.7 per cent in their series with 4.75 per cent in our midforceps cases, yet it is obvious that they have corrected their figures with different factors than we used. Our figure of 4.75 per cent was corrected by the elimination of macerated stillborn infants, babies with congenital anomalies incompatible with life, and babies under 3 pounds that died. (There were none of this latter group in our series.) In their patients they eliminated, in addition to those just mentioned, patients with prolapsed cord (5), premature separation of the placenta (1), "placental insufficiency" (1), adrenal necrosis of Haas (1), and erythroblastosis (1). In order to make a more accurate comparison of the two groups of cases these nine cases should be included in the fetal mortality in their series. The figure for their cases would then be 3.5 per cent. They failed to mention that we stated in our paper that in 17 babies trauma could not be definitely excluded as a cause of fetal death. This would give us a fetal mortality of 3.1 per cent due to this factor. This figure is the one that should be compared to their 2.7 per cent mortality as it is more nearly corrected for the same factors they have used. It is also worth while mentioning that in the last 329 cases of our series of 547 the fetal mortality as a result of trauma was 0.6 per cent, which led us to conclude we were using midforceps less often in unsuitable cases.

Drs. Erving and Kenwick have also offered as rebuttal to our remark "when forceps fail there is little reason to believe that a live, uninjured baby can be obtained by version and extraction," forty-nine infants delivered by this method following failed forceps. To me this represents an uncommonly large number of failed forceps or else they have used different criteria for failed forceps than we had in mind. We consider forceps to have failed when after proper application delivery cannot be completed. We do not include in this group those cases in which we were unable to apply the forceps properly. This latter group is classified as "attempted forceps."

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MARCH 3, 1954

Reply of Drs. Erving and Kenwick

To the Editors:

We welcome the opportunity to discuss the points brought out by Dr. Wayne Decker in his letter regarding our recent paper on internal podalic version and extraction (AM. J. OBST. & GYNEC. **67**: 315, 1954) in which we cited his paper on midforceps (AM. J. OBST. & GYNEC. **65**: 294, 1953).

As stated in our article the corrected fetal mortality excluded 32 of the 63 babies lost. Dr. Decker apparently takes exception to our including nine cases of these 32, claiming that we have corrected our figures with different factors than he used. Table XI in our paper lists the specific cause of death as determined by postmortem examination. Even if a baby was macerated but a specific cause of death was determined, it was listed under the actual cause. Therefore, the "macerated viable stillborn" category of Dr. Decker would include the five cases of prolapse of the cord in which the fetal heart sounds were not heard prior to delivery, the case of premature separation and prolapse of the

placenta, the case of "placental insufficiency" which was caused by a tight true knot in the cord, and the erythroblastotic infant. All had evidence of maceration. Further following his category of "babies with congenital anomalies incompatible with life," the case of adrenal necrosis of Haas must surely be encompassed. This last baby was the only liveborn of the debated group. We regret this misunderstanding but it was caused by our desire to be as specific as possible in the causes of fetal death. We feel that our corrected fetal mortality rate of 2.7 per cent is entitled to comparison with his 4.75 per cent.

If Dr. Decker is looking for a figure to compare with his 3.1 per cent fetal mortality due to trauma of delivery (17 babies), he should have utilized our "sixteen fetal deaths due to proved or presumed intracranial hemorrhage" for a figure of 1.35 per cent. Our 2.7 per cent corrected fetal mortality which he wishes to compare to his 3.1 per cent (instead of 4.75 per cent) included deaths due to prematurity (7), prematurity and toxemia (1), prematurity and placenta previa (1), prematurity and sclerema (1), unexplained (3), and pulmonary atelectasis (2).

Dr. Decker's differentiation between "failed" and "attempted" forceps seems to us to be a play on words and of minor significance. Forceps are supposed to be used primarily in cases where there is no true cephalopelvic disproportion, and only when they can be applied properly and when excessive traction is not required for delivery. We prefer version and extraction to poor application and/or excessive traction with forceps. The fact that we had 49 successful versions and extractions after failed or attempted forceps means either we are less adept in the use of forceps or we are more skilled in versions and extractions. Anyway, we got away with 49 live babies after failing to use forceps successfully. Drs. Decker, Dickson, and Heaton, after nine failed forceps, ended up with 6 cesarean sections, 3 versions, 2 dead babies, and one dead mother. As these 9 cases do not seem to be listed in their results, a better title for their paper might be "An Analysis of Five Hundred Forty-Seven Successful Midforceps Operations."

Due to an error in cross indexing we have to correct our figures for ruptured uteri in our series of versions. Instead of one as reported in the series we find that there were four. However, the maternal mortality remains the same.

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ANTHONY N. KENWICK, M.D.

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MARCH 22, 1954

Etiology of Pre-eclampsia

To the Editors:

No theory can assail the aetiology of pre-eclampsia if it ignores the possible role played by water and salt retention. Drs. Venning, Singer, and Simpson[1] are to be congratulated on their effort in attacking this essential of the problem. The content of their thesis is that there exists both a qualitative and a quantitative change in the excretion of urinary corticoids in pre-eclamptic toxaemia and that this implies an increased and an altered adrenocortical activity, probably as the result of "stress."

Unfortunately, their data are not such as can be set forth in logical propositions. For it is seen that while the formaldehydogenic steroids showed a marked increase in both mild and moderate toxaemia over their amounts in normal pregnancy, there occurred (surprisingly) a sharp decline—even to levels below that found in the healthily pregnant—in severe pre-eclamptic states. Inconsistency was further emphasised by the fact that glucocorticoid function was always reduced, although there was evidence of concurrent increased activity of the adrenal gland in other directions.

The enhanced sodium-retaining effect of the urinary metabolites is presumably ascribed to altered tubular handling of the electrolyte by a salt-retaining mineralocorticoid. Yet glomerular ischaemia could equally achieve such an effect in response to renal pressor substances[2] and no evidence of the exclusion of this mechanism is provided by the data.

If "stress" did account for the increased corticoid excretion in toxaemia, then, quite contrary to expectation, the figures for the urinary corticoids deny it any influence in pregnancy complicated by essential hypertension.

Dieckmann,[3] in applying the Kepler test of adrenocortical function to toxaemic patients, found that 40 per cent responded in a manner similar to those with Addison's disease, in whom salt *loss,* not salt gain, is the characteristic feature, once again militating against the employment of concepts of adrenocortical dysfunction in the aetiology of pre-eclampsia.

"Stress" is ubiquitous. It can be invoked in explanation of almost any disease. The functions of the adrenal gland are multilateral. Drs. Venning, Singer, and Simpson additionally claim they are subject to "qualitative" change. There appears to be no restraint to conjecture. The same gland contemporaneously can exercise a heightened electrolyte function while displaying a reduced glucocorticoid activity.

The introductory paragraph grouped oedema, hypertension, and albuminuria together as effects of substances directly influencing fluid and electrolyte balance. Albuminuria directly attributable to adrenocorticoid influence has not been shown to occur. As a corollary, neither has cortisone, the "antidote" for stress, proved effective in the treatment of pre-eclampsia, while in the complete absence of the antidiuretic hormones toxaemia can supervene in diabetes insipidus. But, above all, in the aetiology, it is not pregnancy but primiparity that demands the emphasis. Placental change or disordered adrenal function cannot be the prerogative of the primigravid organism exclusively.

It is reasonable to assume that the common factor present in the first pregnancy, in hydramnios, in multiple pregnancy, and in concealed rather than in revealed accidental haemorrhage—heightened uterine tension—offers the aetiological explanation,[2] rather than disordered function of the adrenal gland.

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APRIL 1, 1954

1. Venning, E. H., Singer, B., and Simpson, G. A.: AM. J. OBST. & GYNEC. 67: 542, 1954.
2. Sophian, J.: Toxaemias of Pregnancy, London, 1953, Butterworth & Co., Ltd., pp. 61-65.
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Erratum

To the Editors:

Dr. Joe V. Meigs has written you that I took issue with the diagnosis of carcinoma in situ for Fig. 3 in the paper by A. F. Daro et al., in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY 67: 15, 1954. Whatever the lesion may have been that was seen by the pathologist, the photograph shows almost normal stratified squamous epithelium. It is unfortunate if this is the histological picture now being diagnosed as carcinoma in situ. The Editorial Board should help to rectify and explain this mistake.

ROBERT H. FENNELL, JR., M.D.
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Boston, Mass.

Reply by Dr. Daro

To the Editors:

The criticism by Dr. Fennell and Dr. Meigs of Fig. 3 of our article is correct; the wrong area was photographed and submitted by error for publication.

Fig. 1 shows the entire area of biopsy. Point *A* is the area of carcinoma in situ. Point *B* shows the area which was photographed for the article. Fig. 2 shows the area of carcinoma in situ in high power.

AUGUST F. DARO, M.D.

55 East Washington Street,
Chicago 2, Ill.
May 5, 1954.

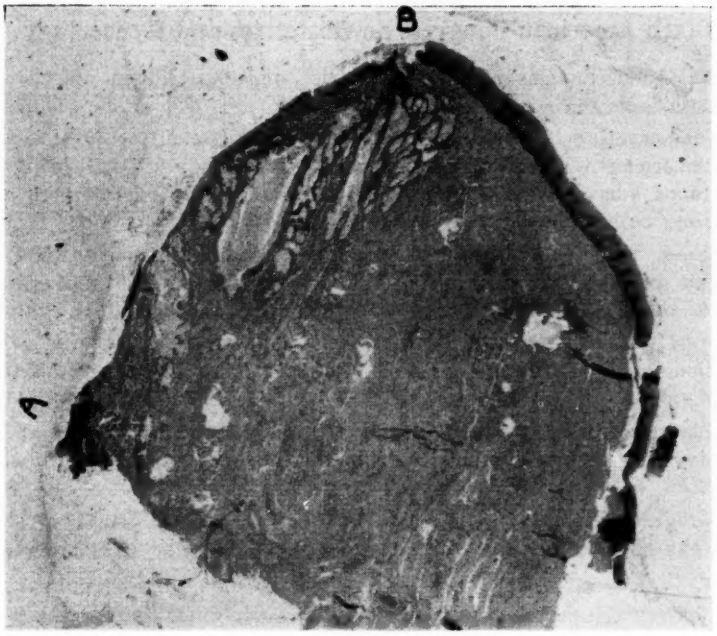

Fig. 1.

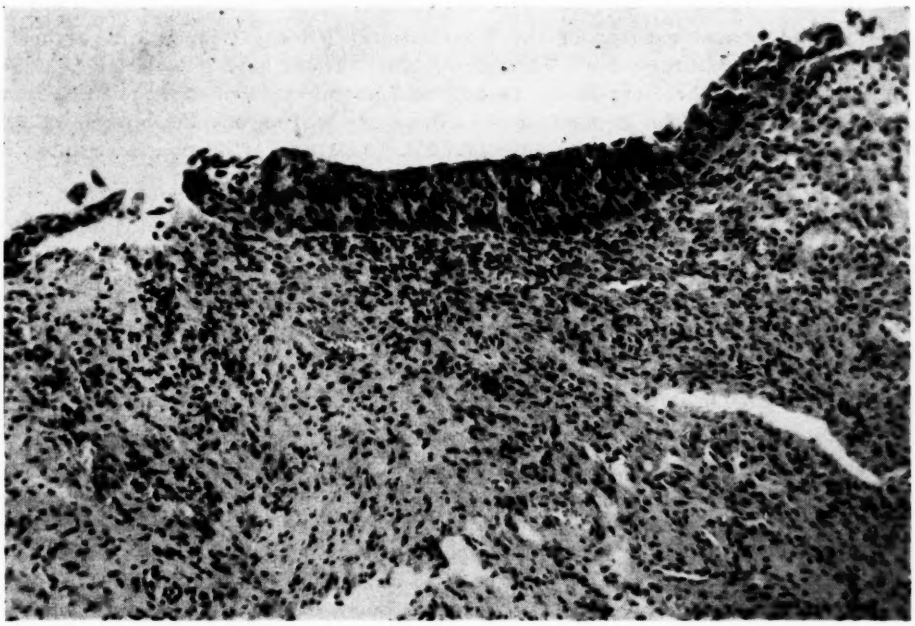

Fig. 2.

Items

Sixth American Congress on Obstetrics and Gynecology

The Sixth American Congress on Obstetrics and Gynecology will be held at the Palmer House, Chicago, Dec. 13-17, 1954.

The five-day meeting is sponsored by the American Committee on Maternal Welfare, Inc., and the American Academy of Obstetrics and Gynecology. It will bring together the four major groups concerned in the provision of better care for mothers and babies—medicine, nursing, public health, and hospital administration.

The program will include twenty-seven formal papers, twenty-two symposia and panels, luncheon discussion groups, and several hundred round-table discussions, covering every phase of maternal and newborn care. Scientific and technical exhibits are also being planned.

Information about the meeting may be obtained by writing to the Sixth American Congress on Obstetrics and Gynecology, 116 South Michigan Avenue, Chicago 3, Ill.

General chairman is R. Gordon Douglas, M.D., professor of obstetrics and gynecology at Cornell University Medical College and obstetrician and gynecologist-in-chief at New York Hospital.

General program chairman is Lawrence M. Randall, M.D., professor of obstetrics and gynecology at the Mayo Foundation Graduate School, University of Minnesota, Rochester, Minnesota.

Inter-Society Cytology Council

The second annual meeting of the Inter-Society Cytology Council will be held in Boston, Friday and Saturday, Nov. 12 and 13, 1954. Those having material to present are invited to submit three copies of the title and an informative abstract of not more than 200 words to Dr. John B. Graham, Chairman of the Program Committee, 32 Fruit Street, Boston, Massachusetts, before July 15, 1954. Abstracts of all papers accepted will be published in the official program.

Registration will be open to everyone interested in cytology. Registration fee for physicians is $5.00; for cytologic technologists, technicians, and others, $2.00. Medical students, interns, and residents will be admitted without charge.

For additional information please contact the Secretary-Treasurer, Inter-Society Cytology Council, 634 North Grand Blvd., St. Louis 3, Missouri.

Silver Anniversary of Central Association

The Central Association of Obstetricians and Gynecologists will celebrate the Silver Anniversary of its founding at the annual meeting to be held at the Jefferson Hotel in St. Louis, Missouri, Oct. 7 to 9, 1954. At the same time the twenty-fifth anniversary of the discovery of crystalline estrogen by Dr. Edward Doisy of St. Louis will be observed.